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WILLIAM CROOKES, F.R.S., &c.

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THE CHEMICAL NEWS.

VOLUME XXXI.

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ON ATTRACTION AND REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

(1). IN a paper "On the Atomic Weight of Thallium," presented to the Royal Society June 18, 1872, after describing a balance with which I was enabled to perform weighings of apparatus, &c., in a vacuum, I noted a peculiarity in relation to the effect of heat in diminishing the apparent weight of bodies. I said, "That a hot body should appear to be lighter than a cold one has been considered as arising from the film of air or aqueous vapour condensed upon or adhering to the surface of the colder body, or from the upward currents of air caused by the expansion of the atmosphere in the vicinity of the heated body. But neither hypothesis can be held when the variation of the force of gravitation occurs in a vacuum as perfect as the mercurial gauge will register, and under other conditions which I am now supplying, and which I purpose embodying in a paper to be submitted to the Royal Society during a subsequent session."†

With the vacuum-balance mentioned above I carried out many experiments, but was unable to obtain results which were at all concordant; and it was soon found necessary to investigate the phenomena with smaller and less complicated apparatus.

(2). Most chemical manuals warn beginners against the errors occasioned by weighing substances while hot; and, up to a moderately high degree of exhaustion, I was prepared to find a piece of glass apparatus, when hot, apparently lighter than the weights which should balance it were the whole system at the same temperature. But, instead of the interfering causes diminishing as the rarefaction proceeded, they seemed rather to increase, or at all events to become irregular in their action, sometimes appearing to oppose, and at others to supplement the force of gravity. In such a vacuum as a good air-pump would produce, the actions of the ascending current of air and of the adhering film, it might be presumed, should cease to exert an influence; and I could think of no other disturbing cause except the lengthening of the beam, owing to the heat radiated from the apparatus below it. An increase in the length of the beam should make a mass suspended at its extremity appear heavier; but, whilst I frequently noticed an action which might be due to this cause, I occasionally obtained results which were so anomalous as to convince

me that some cause which I had not hitherto recognised was at work (49), and to lead me to hope that perhaps I might succeed in tracing a connection between heat and the force of gravity.

(3). Many physicists have worked on the subject of repulsion by heat. I give here a brief *resume* of the state of knowledge on this subject up to the time of my commencing these experiments, premising, however, that much of this historical information was unknown to me until some of the experiments here recorded were finished and I commenced putting my notes together. The earliest mention I can find is by the Rev. A. Bennet, F.R.S., who in the year 1792 published a paper* on "A New Suspension of the Magnetic Needle intended for the Discovery of Minute Quantities of Magnetic Attraction; also an Air-Vane of Great Sensibility; with New Experiments on the Magnetism of Iron Filings and Brass." Mr. Bennet used a spider's thread as a means of suspension. This he found by experiment to be absolutely free from torsion. I quote the following experiments from his paper:—

"Experiment IV.—A bristle was suspended horizontally by a spider's thread, somewhat stronger than the last, and after turning the wheel till it produced 4800 revolutions, it shortened the thread from 3 inches to 1 inch; yet either end of the bristle would move towards any warm substance which was presented to it either with or against the direction of the twist.†

"Experiment V.—Several other light substances were suspended by fine spiders' threads and placed in a cylindrical glass about 2 inches in diameter, as the thinnest part of the wing of a dragon-fly, thistle-down, and the down of dandelion; of these the last appeared most sensible to the influence of heat; for when this down was fastened to one end of a fine gold wire, suspended horizontally on to one end of two bits of straw joined together in the form of the letter T inverted, it would turn towards any person who approached it at the distance of 3 feet, and would move so rapidly towards wires heated by my hand, as very much to resemble magnetic attraction.

"Experiment VI.—A bottle filled with cold water was brought near the glass cylinder standing in a warm room, and soon after the down of dandelion appeared to be repelled by the bottle by turning away from it. The bottle was removed to the other side, and the dandelion again moved towards the opposite side.

"Experiment VII.—A piece of paper was tied over the mouth of a glass jar, about 4 inches in diameter. Two holes were made in the paper opposite to each other, and

* From the *Philosophical Transactions of the Royal Society of London*, vol. clxiv., part 2.

† *Phil. Trans.*, 1873, vol. clxiii., p. 287.

* *Phil. Trans.*, 1792, p. 81.

† For a re-discovery of this fact, seventy-nine years after, see par. 14.

near the edge of the glass. The jar was placed upon a table, and suffered to stand a considerable time to cool in a room without fire. I then sat near it on the side where one of the holes in the paper was in the nearer and the other in the farther end of the diameter. I next filled another glass with smoke, and placed it with its mouth over the two holes in the paper. The smoke was now seen to descend through the farthest hole, and mixing with the air in the lower jar, plainly showed that the air moved slowly towards the side of the glass warmed by the heat of my body.

"Experiment X.—To the end of a fine gold wire 3 inches long, and suspended by a spider's thread in a cylindrical glass, was fastened a small circular bit of writing-paper; light was admitted through a small hole, and also the focus of a large lens was thrown upon the paper, with the intention of observing whether it would be moved by the impulse of light; but though these experiments were often repeated, and once with the paper suspended in an exhausted receiver, yet I could not perceive any motion distinguishable from the effects of heat. Perhaps sensible heat and light may not be caused by the influx or rectilinear projection of fine particles, but by the vibrations made in the universally diffused caloric or matter of heat or fluid of light. I think modern discoveries, especially those of electricity, favour the latter hypothesis."

(4). In his "Elementary Treatise on Heat,"* Professor Balfour Stewart, F.R.S., cites this experiment of Mr. Bennet's as one of the arguments against the emissive and in favour of the undulatory theory of light and heat. Bearing in mind the overwhelming proofs we now possess that the undulatory theory more nearly expresses the truth than does the emissive theory, it is not likely that the very different results I have succeeded in obtaining (56, 57, 58), by the employment of instruments of a delicacy unattainable eighty years ago, will have any weight in modifying the accepted theories of light and heat.

(5). The next mention of the dynamic action of heat is by Laplace, who, in his "Mécanique Céleste,"† speaks of the "repulsive force of heat" as subsisting among the particles of a fluid, but observes that experiment shows it has no other effect on capillary attraction than what results from its diminishing the density of the fluid.

(6). In the year 1824 Libri‡ published some experiments on the movement of translation experienced by a drop of liquid suspended to a metallic wire, one of the ends of which is heated. This he inferred was due to repulsion produced by the heat between the wire and the particles of the liquid. The Rev. Baden Powell, F.R.S., says|| that trying to repeat Libri's experiment he has never been able to succeed, except in producing a slight apparent motion in the drop, which seems explicable from the mere effect of evaporation on the side next the heat.

(7). In the *Annales de Chimie et de Physique* for 1825§ are two papers by Fresnel, in which he gives an account of an experiment on the repulsion exerted by heat. To the two extremities of a fine magnetic needle, suspended by a cocoon fibre, he attached vertical disks of foil and mica, so as to test with the same apparatus an opaque and a transparent body. The fixed body which was to repel the torsion-balance was another disc of foil. The whole was covered with the receiver of an air-pump, and a vacuum, up to 1 or 2 m.m., was obtained. The whole was then taken into sunshine, and turned so that the needle was kept slightly out of the magnetic meridian by pressure of the fixed disk against one of the movable disks. On concentrating the sun's rays on either of these disks, they instantly separated, sometimes to the extent of a millimetre. On withdrawing the lens, the torsion-balance only gradually returned to its original position. To see if these phenomena were due to the residual gas, air was gradually let in; and

on repeating the experiment when the density of the enclosed air was fifteen or twenty times greater than at first, it was found that the repulsion had not sensibly increased, as it should have done had it been due to currents of heated air. Under some conditions, indeed, the movement was not so great as in a vacuum. Sometimes Fresnel observed an action of attraction, the disks adhering when heated, and separating when the lens was removed. With pieces of copper suspended to the magnetic needle the attraction was very apparent; when the movable and fixed disks were near together, they approached on applying heat. Reasons are given why these effects cannot be due to electricity or magnetism, but the author does not seem to have tried any further experiments.

(8). M. Saigey in 1827* described an experiment with a needle of lead delicately suspended at different distances from a bar of copper. He found the number of oscillations in a given time decrease with the distance. From his experiments he arrived at the following results:—All bodies exert between themselves a feeble repulsive action under ordinary circumstances. A very marked attraction may be observed between a cold and a heated body, or between two bodies of different temperatures, whether screens be interposed or not. Saigey concludes that in many cases results obtained without the appreciable development of magnetism or electricity have been attributed to these forces.

(9). In the year 1834 Professor J. D. Forbes† published an elaborate research on the vibrations which Mr. A. Trevelyan had found to take place between metallic masses having different temperatures. The general conclusion at which he arrived is, that there is a repulsive action exercised in the transmission of heat from one body into another which has a less power of conducting it. These repulsions only take place between bodies having a certain amount of conducting-power, below which some metals fall; it must be excitable in a most minute space of time, and is energetic in proportion to the difference of conducting-power of the substances and to their difference of temperature.

(10). The Rev. Baden Powell, in the same year,‡ published a paper "On the Repulsive Power of Heat." He employed an arrangement somewhat similar to Fresnel's (7), the disks being two small plates of glass with truly plane surfaces. He found that if in the first instance they were pressed together so as to adhere, heat always overcame the attraction, and the movable disks sometimes receded to a sensible distance; but Professor Powell says that this effect (and perhaps also that in Fresnel's experiment) appeared to him in a great measure due to another cause than repulsion, viz., the slight curvature which will be given to the plate of glass by the greater expansion of the more heated surface producing a convexity towards the heat.

(11). By pressing the disks closely together, the coloured rings formed would give a test of the interval between the disks. Professor Powell found that the tints invariably descended in the scale when heat was applied, showing that the interval between the disks increased, and proving the existence of a repulsive power exerted between heated surfaces at small, though sensible, distances—the warping, or change of figure, if any, in the glasses by heat being readily seen to be such as ought to cause the rings to enlarge at the first instant. From experiments made by the contact of a lens with different substances, Professor Powell inferred that whatever tends to increase the rapidity of communication of heat, tends to increase the observed effect. The effect is increased when water, instead of air, is introduced between two lenses.

(12). In 1838 Professor Powell|| gave some additional notes on the same subject, but no new form of experiment was tried.

* Oxford, at the Clarendon Press, 1866, pp. 161, 352

† *Suppl. Livr.*, x., p. 75, A.D. 1799—1805.

‡ *Mem. Accad. Torino*, xxviii.

§ *Phil. Trans.*, 1834, p. 485.

|| *Vol. xxix.*, pp. 57, 107.

* *Bulletin Mathématique*, tom. ix., pp. 89, 167, 239; tom. xi., No. 167. *Bull. Sci. Nat.*, viii., p. 287.

† *Trans. Roy. Soc. Edinburgh*, vol. xii., p. 429.

‡ *Phil. Trans.*, 1834, p. 485.

|| *Phil. Mag.*, vol. xii., April, 1838.

(13). Dr. Joule, F.R.S.,* gave an account, in 1863, of a new and extremely sensitive thermometer. It was based upon the disturbing effect of currents of air upon finely-suspended magnetic needles. By diminishing the directive force of the needle, the instrument was made sufficiently delicate to move to the heat radiated from a small pan containing a pint of water heated to 30° , placed 3 yards off, and also to give evidence of the heat of the moon. I have little doubt that these movements were not so much due to currents of air as to the mechanical effects of radiation described in this paper.

(14). It is right that I should mention here that in September, 1871, I received a letter from Mr. J. Reynolds, mentioning that he had constructed a little instrument which would turn to the hand, to a fire, or to any source of heat. It consisted of a thin slip of deal suspended by a filament of spider's web, and enclosed in a thin glass flask. This little instrument was more sensitive than any I had then constructed, as the spider's web was much freer than cocoon-silk from torsion, and Mr. Reynolds kindly allowed me to experiment with it.

(15). I cannot do better, in bringing this historical summary to a conclusion, than draw attention to a passage written in 1868 by Professor Guthrie, F.R.S.,† in which he distinctly points out a probable relation between heat and gravity. He says:—"If the ætherial vibrations which are supposed to constitute radiant heat resemble the aerial vibrations which constitute radiant sound, the heat which all bodies possess, and which they are all supposed to radiate in exchange, will cause all bodies to be urged towards one another."

(16). Were it such a relation between heat and gravity of which I had been getting glimpses, it was evident that a much more delicate apparatus would be necessary to render it distinct, and I accordingly commenced a series of experiments with the view of ascertaining what form of apparatus would be most sensitive to the action sought.

The first requisite was to get rid of the error arising from the expansion of the beam by heat; and since, in working with hot bodies, the metallic masses used as weights would themselves become warm, and since the action I sought to establish was only likely to be due to a difference in temperature between the hot body on one arm of the balance and the cold weights on the other arm, both being under the influence of the same force of gravity, I endeavoured to obtain the desired results by means of a spring-balance, one in which the variations of gravity should be measured, not against gravity itself, but against the tension of a spring.

(17). I tried many forms of spring-balance, and obtained with them results which, at the time, I thought sufficiently satisfactory. The sources of error were, however, so numerous, and the manipulation was so difficult, that I ultimately gave up that form of balance in favour of the one usually employed.

In order to obtain a very high degree of rarefaction, without the trouble and uncertainty attending the use of an ordinary air-pump, it was necessary to have the balance sufficiently small to enable it to be exhausted by the Sprengel pump.

Before proceeding to the forms of apparatus finally adopted, and the experiments made therewith, it will, I think, be useful, for the sake of other experimentalists, if I briefly describe some of the arrangements successively tried and rejected, with the reasons for so doing.

(To be continued.)

Procedures for Determining Thein in Tea.—M. R. Weyrich has made a comparative investigation of the methods proposed of Mulder, Peligot, Claus, Zoeller, and Liventhal, and gives the preference to the first-mentioned.

* CHEMICAL NEWS, vol. vii., p. 150.

† Proceedings of the Royal Society, vol. xix., p. 35.

LECTURES ON THE MORPHOLOGY OF CRYSTALS AT THE CHEMICAL SOCIETY.

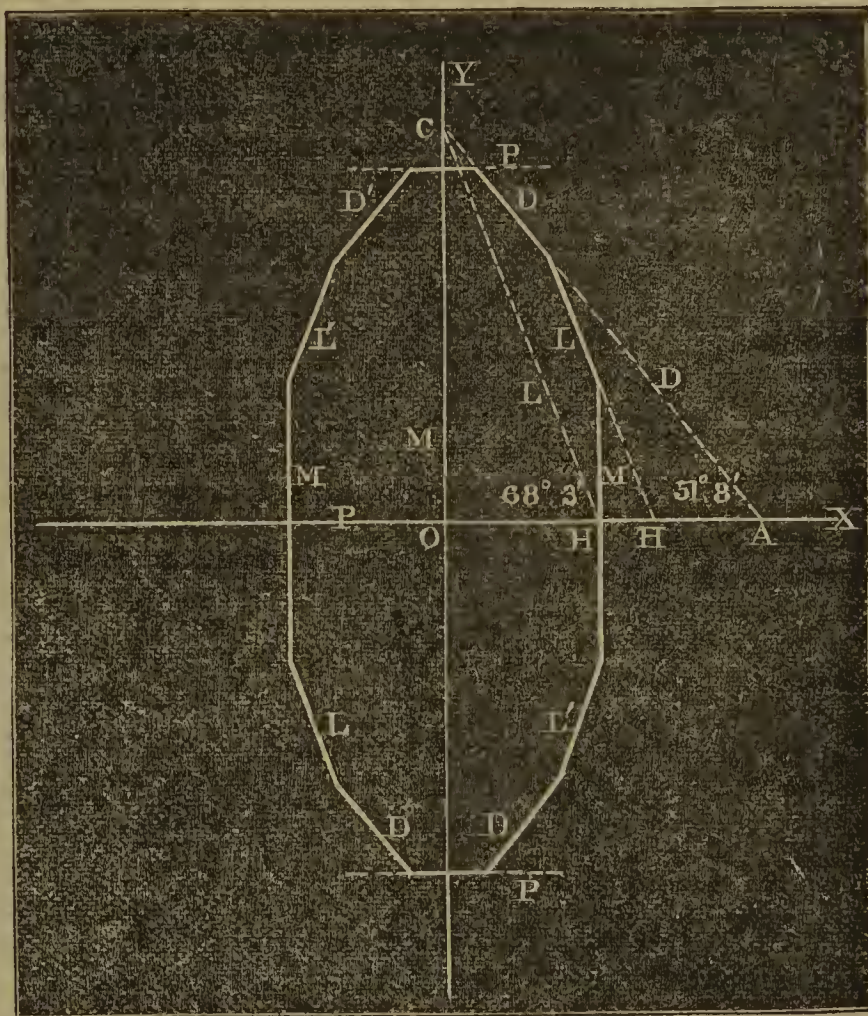
By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

I.

THE lecturer, after defining crystallography as the science dealing with chemical morphology, took in hand a large crystal of apophyllite, and pointed out that its faces were of three kinds, and that those of each kind were symmetrically disposed; the similarity of the faces of each kind being at once recognisable in the nature of its surface and physical features no less than in its form. A group of such similar repeated faces he designated as a *form*. The repeated morphological features of a crystal are its faces, its edges, and its quoins (or solid angles). It was seen that the *faces* belonging to either of the three forms on the crystal of apophyllite differed in magnitude; whereas the repetition of an *edge* implies absolute constancy in the dihedral angle so repeated.

This result, of equality in the edge-angles, brings the crystal under the domain of number—makes it, in short, an exact science.

A crystal was defined as a system (*συστημα*) of molecules belonging to an individual substance, symmetrically arranged, and presenting the same properties along all lines taken parallel to the same direction, or to directions that are similarly disposed in respect to symmetrically-



repeated features. The properties and external characters that distinguish the faces of one form from those of another were treated as the results of properties in the crystal; such, for instance, as the character of its cohesion perpendicularly to the face. Where faces are parallel to cleavages, the directions of least cohesion are perpendicular to such faces.

The first subject for consideration is the mode of measuring an edge, by determining, in one form or other, the angle made by two lines meeting in the edge perpendicularly to it; of which lines, one lies in each of the planes.

The kinds of goniometer in use for measuring angles were alluded to in passing; and the lecturer went on to

take the case of four faces of a crystal of barytes, which he exhibited. These faces had all their edges parallel, and so served to define a *zone*. Supposing a section to be made through the crystal perpendicularly to all these planes (and so to their edges), he gave a profile view of this section, which he termed the *zone-plane* of the zone of the four faces, M, L, D, P.

The method of employing two fixed lines (in this case perpendicular to each other) as axes to which the faces should be referred, was then explained; and, as the planes M and P were at right angles, their profile lines, or "traces," on the plane of the zone (the plane in which the figure was drawn) were taken for the directions of the axes X or Y; but lines parallel to them, passing through a point, O, inside the crystal, were actually taken for the axes. On the line P, *i.e.*, the axis X, the line L (representing the plane L) forms an angle of $68^{\circ} 3'$, the line D making with that line an angle of $51^{\circ} 8'$. To compare these planes, lines parallel to the lines L and D were made to pass through the same point, C, on the axis Y; and then we have—

$$\frac{OC}{OA} = \text{tangent } 51^{\circ} 8' = 1.24079,$$

$$\frac{OC}{OH} = \text{tangent } 68^{\circ} 3' = 2.48132,$$

as found by calculation from logarithmic tables.

$$\text{Hence } OC = 1.24079 \times OA = 2.48132 \times OH,$$

$$\text{And } \frac{OA}{OH} = \frac{2.4813}{1.2407} = \frac{2}{1} \text{ very nearly.}$$

The numbers being more nearly 2:1, in proportion as the angle to be measured allows more precise determinations of the value of the angles.

If we represent OA, OC, OH by a , c , $\frac{a}{2}$, respectively,

$$\text{the ratio of } OC : OA = \frac{c}{1} : \frac{a}{1}$$

$$OC : OH = \frac{c}{1} : \frac{a}{2}.$$

Treating the zone as thus represented, merely by lines which are the traces of faces in the zone on a plane, we may say that the ratio of $a : c$ is the parametral ratio, a and c being the parameters of the zone, as referred to M and P as axes; and the numbers by which these parameters have to be divided for each plane are called the *indices* of the plane—1,1 being the indices of D, 1,2 those of L, and these, bracketed, give symbols (1,1) and (1,2) for symbols of the planes, as referred to two axes parallel to the traces of two planes in the zone.

(To be continued).

ON THE EFFECT OF HEAT ON IODIDE OF SILVER.*

By G. F. RODWELL, F.R.A.S., F.C.S.

(Concluded from page 280.)

It has been before stated that at the moment of solidification of a mass of iodide of silver a considerable contraction takes place. The following experiments were made in order to determine the amount of this contraction. A copper tube, which contained 105.548 grammes of mercury, was found to contain 42.080 grammes of iodide in a molten condition (say 450°C.), that is a little above the fusing-

point of the iodide. This would give as the specific gravity of the molten iodide 5.406. The mass was then allowed to solidify in the tube, and a large conical cavity appeared at the moment of congelation. This cavity contained 4.552 grammes of mercury, and would contain 1.8149 grammes of iodide. Hence, if the volume of the iodide before fusion be taken as 100, the volume of the resulting fused iodide will be 104.499. Or, again, 100 volumes of molten iodide contract to 95.694 volumes of the solid. If the volume at the point of maximum density (116°C.) be taken as unity, the volume of the molten iodide will be 1.04499. The principal expansion takes place at the moment of fusion, and the expansion between 116°C. and 450°C. is not considerable. No really satisfactory method has been yet found for determining the coefficient of expansion between 116°C. and 145°C. ; but if we assume it to be equal to the mean expansion on the other side of 116°C. (of course omitting the sudden expansion which takes place when the amorphous passes into the crystalline condition,) we find that a volume 1.0 at 116°C. will become a volume of 1.01455238 at 450°C. just below the melting-point, while in passing from the solid to the liquid condition the volume increases from 1.01455 to 1.04499, an expansion = 0.03044.

When a mass of iodide of silver passes from the amorphous into the crystalline condition the molecular commotion is so considerable that portions of the mass are sometimes jerked off from the ends of a bar, and large fissures appear in the mass. These are sometimes as much as half a millimetre broad and several centimetres long in a cylindrical mass, weighing from 10 to 20 grammes. They penetrate to the centre of the mass, as may be shown by cooling the iodide under mercury, when the whole mass is found to be permeated by the metal. The capacity of these intercrystalline spaces was determined by allowing a known weight of iodide to pass from its amorphous to its crystalline condition beneath the surface of mercury, and again weighing.

α . 3.643 grammes AgI after thus cooling weighed 3.968 grammes.

β . 5.913 grammes AgI after thus cooling weighed 6.417 grammes.

And as we know the specific gravity of mercury and of the iodide, it is easy to deduce from the above that the volume of the cracks is represented respectively by (α) 0.1353 gramme and (β) 0.2098 gramme of iodide; hence—

$$\alpha. 3.643 : 0.1353 :: 100 : 3.7112$$

$$\beta. 5.913 : 0.2098 :: 100 : 3.5481$$

which give a mean of 3.6296. Therefore 100 grammes of iodide in the amorphous condition produced, in passing into the crystalline condition, intercrystalline spaces capable of containing 3.6296 grammes of iodide. From an observation which was made on a cylindrical mass of iodide a centimetre diameter, which in undergoing expansion in the passage from the amorphous to the crystalline condition had produced a separation amounting to half a millimetre in a tube which had yielded to the expansion, the expansion of the mass, *plus* the intercrystalline spaces within it, was found to be 0.047619; hence a volume of amorphous iodide represented by unity, becomes a volume of 1.047619 in passing into the crystalline condition, *plus* the intercrystalline spaces; and the volume of these spaces having been determined above, we find that the actual change of volume which takes place simultaneously with the change of molecular condition amounts to 0.011323; that is, a volume of iodide at its point of maximum density (116°C.) represented by unity, becomes a volume of 1.011323 in changing to the crystalline condition.

Frequent fusion and cooling appear to render a mass of iodide more brittle and crystalline, and to promote the formation of large fissures. The iodide prepared by dissolving silver in hydriodic acid and subsequent fusion,

* A paper read before the Royal Society.

was less brittle than that produced by precipitation and frequently fused. We have before noticed that while the latter passes into its crystalline condition at a temperature ranging a few degrees on either side of 116°C. , the former may sometimes be cooled to much lower temperatures without change. In fact it appears to be altogether more compact and horny, and almost free from intercrystalline spaces than the fused iodide produced by precipitation. The specific gravity appears also to be slightly higher. Boullay found the specific gravity of the fused iodide produced by precipitation to be 5.61, but he was probably unaware of the presence of the intercrystalline spaces, or he did not take special precautions to obviate them. An ordinary fused mass of iodide was found to have a specific gravity of 5.545, when no precautions were taken to dislodge the air from the intercrystalline spaces. Now we have before given reasons for believing that a volume of iodide at its maximum density (116°C.) becomes a volume of 1.047619 in changing to the crystalline condition; and if we take the specific gravity to be 5.816 at the maximum density, we deduce the specific gravity in the crystalline condition, not taking into account the intercrystalline spaces, to be 5.561,—

$$1.0476 : 1 :: 5.816 : 5.561,$$

a number which differs by only 0.016 from the specific gravity found by direct weighing, when no precautions were taken to dislodge air from the intercrystalline spaces. When, however, the mass of iodide was boiled for a length of time in water and cooled in a good vacuum, the specific gravity at 0°C. was found to be 5.681. Deville found it under the same conditions to be 5.687*. The specific gravity of the molten iodide has been shown above to be about 5.406, and the specific gravity at the point of maximum density of the amorphous iodide would appear to be 5.8167. This applies to the precipitated iodide which had been several times fused, and with which the principal experiments herein described were made. A specimen of iodide produced by the direct solution of silver in hydriodic acid gave a specific gravity of 5.812, and appeared to be less crystalline, and more compact than that produced by precipitation. Deville found the specific gravity of the unfused precipitated iodide to be 5.807, and of the fused iodide 5.687, while Damour found the native crystals to have a specific gravity of 5.667, hence the amorphous precipitate has a higher density than either the fused crystalline iodide and their native crystals. Thus the density of the amorphous precipitate coincides almost perfectly with the density of the fused iodide at its point of maximum density (116°C.) when in the amorphous condition, as deduced from the above experiments.

If we place in a specific-gravity flask a quantity of fused iodide of silver, fill it up with mercury (taking every precaution to displace the air from the intercrystalline spaces), and place in the ground neck of the flask a perforated stopper continued as a capillary thermometer stem, we have obviously a thermometer in which we can observe the effect produced by the anomalous contraction of the iodide on the regularly expanding mercury. On applying heat to such an arrangement we observe that for a while the mercury rises in the stem, until on further heating the contraction of the iodide exceeds the expansion of the mercury, and the column retreats if much iodide is present into the very bulb of the instrument.

If the heating be now discontinued the mercury slowly rises as the iodide cools, until the contraction of the mercury exceeds the expansion of the iodide, beyond which point the mercury continues to sink as the bulb cools. Nothing could better illustrate the complete inversion of the effects usually produced by heat on bodies in the case of the iodide of silver.

Professor Guthrie suggested to me that a convenient method of determining the amount of contraction produced by heat in the iodide, would be to fill a specific-gravity

flask with mercury, and determine the amounts of mercury exuded from the flask for every ten or twenty degrees of temperature; then to place in the flask a known weight of fused iodide with a known weight of mercury, and repeat the determinations. This was accordingly done. About 440 grammes of mercury were employed, and weighings made at intervals of a few degrees. The method was found to be satisfactory, and the results concordant. For example (to take a few instances from many), the amounts of mercury driven from the flask by expansion for 10°C. were found to be as follows.—

Between 29°C. and 53°C.	..	0.066062
„ 22°C. „ 74°C.	..	0.067250
„ 20°C. „ 84°C.	..	0.067390
„ 29°C. „ 86°C.	..	0.068526
„ 47°C. „ 84°C.	..	0.069297

Numbers which, when the necessary corrections have been made for the expansion of the glass, agree very well with Regnault's determinations of the absolute expansion of mercury. Then 38.3680 grammes of the fused iodide were placed in the flask; it was filled up with mercury, the whole was heated, cooled in a good vacuum, weighed; cooled to -18°C. (-0.4°F.) and weighed. The flask was then heated respectively to 0°C. , 21°C. , 67°C. , and the weights determined. At high temperatures the mercury acts upon the iodide and a green iodide of mercury is formed. The results were not very concordant above 67°C. and have not been introduced. The general results were as follows: the amounts of mercury driven from the flask for 1°C. were respectively:—

Between -18° and 0°C.	=	0.052648
„ -18° „ $+21^{\circ}\text{C.}$	=	0.051392
„ 0° „ $+21^{\circ}\text{C.}$	=	0.050285
„ -18° „ $+67^{\circ}\text{C.}$	=	0.049684
„ 0° „ 67°C.	=	0.048873
„ $+21^{\circ}$ „ 67°C.	=	0.048228

Now from the known weight of mercury in the flask and the known expansion of mercury, it is easy to deduce the quantity of mercury which ought to have been driven from the flask by expansion for any number of degrees; and having determined the actual amount of mercury expelled, we at once find the contraction of the known weight of iodide of silver from known number of degrees, by subtracting the amount of mercury expelled from the amount of mercury which ought to have been expelled if the iodide had not been present. We can thus arrive at the coefficient of contraction of the iodide for one degree Centigrade. These appear to be 0.00000718 for temperatures between -18°C. and 0°C. , 0.00003297 for temperatures between 0°C. and 21°C. , and 0.00005570 for temperatures between 21° and 67°C. Thus the coefficient augments with the temperature.

We have endeavoured to prove in the foregoing pages the following main facts:—

1. That the iodide of silver exists in three allotropic forms, viz. (a) at the temperatures between 116°C. and its fusing-point, as a plastic, tenacious amorphous substance possessing a reddish colour, and transparent to light; (β) at temperatures below 116°C. as a brittle, opaque, greenish-grey, crystalline mass; and (γ) if fused and poured into cold water, as an amorphous, very brittle, yellow, opaque substance.
2. That the iodide possesses a point of maximum density at or about 116°C. at the moment before passing from the amorphous into the crystalline condition.
3. That if we allow a mass of molten iodide to cool, the following effects may be observed:—(a) at the moment of solidification a very considerable contraction takes place (β) the solid, on further cooling, undergoes slight and regular contraction after the manner of solid bodies in general, until (γ) at or about 116°C. it undergoes sudden and violent expansion, passing from the amorphous into the crystalline condition; (δ) after undergoing this expan-

* "Sur les Propriétés de l'Iodure d'Argent," *Comptes Rendus*, vol. lxiv.

sion the mass on further cooling undergoes slight expansion, and (ε) the coefficient of contraction diminishes as the temperature decreases (or otherwise expressed, the coefficient of contraction augments with the temperature.)

I must in conclusion express my great indebtedness to Dr. Guthrie for allowing me to carry out many of the foregoing experiments in the Physical Laboratory at South Kensington.

NOTE ON M. VILLE'S EXPERIMENTS,
SHEWING THE
ASSIMILATION OF CERTAIN NITROGENOUS
SUBSTANCES BY PLANTS.

By Dr. CHARLES A. CAMERON.

I HAVE read M. Ville's experimental results in relation to the assimilation of certain nitrogenous matters by plants with great pleasure; they are of the highest degree of interest and importance.

I wish merely to recall to mind that which M. Ville does not appear to be aware of, viz., that in a paper which I read before the British Association, in 1857, I proved that urea was as effective as ammonia in supplying nitrogen to plants. This paper was published *in extenso* in the *Chemist*, November, 1858, and several other journals, including the Paris publication, *Repertoire de Chimie Pur et Applique*, December, 1858.

M. Ville's statement, that plants cannot assimilate nitrites or phosphites, is interesting; but it is in harmony with the observation made early in this century by De Saussure, viz., that plants cannot assimilate the carbon of carbon monoxide, though they can that of carbon dioxide. In 1857, I found that plants could not assimilate the nitrogen of cyanogen gas, but that they were to some extent benefited by the application of cyanide of potassium. M. Ville appears to consider that cyanide and ferrocyanide of potassium exercise only an injurious influence upon vegetation; but my experience in this matter has been different to M. Ville's. I believe that these compounds, applied in small quantities, and in combination with other nitrogenous substances, to plants, aid their growth.

Apropos of ferrocyanide of potassium, I find in the *Proceedings of the Royal Irish Academy* for January 8, 1844, an account of experiments made by the Rev. Thomas Knox, showing that ferrocyanide of potassium produced as great an increase in the yield of a grass crop as the salts of ammonia.

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL
SOCIETY.

Ordinary Meeting, December 1, 1874.

Rev. WM. GASKELL, M.A., Vice-President, in the Chair.

"Some Doubts in regard to the Law of the Diffusion of Gases," by HENRY H. HOWORTH.

The author said that he had a difficulty in reconciling the conclusions drawn by Dalton, Berthollet, and Graham respecting the diffusion of gases with the actual facts of nature, and it seemed to him that the only way in which the inferences drawn from experiments in the laboratory and what was going on in nature on a large scale could be reconciled was in the belief that either diffusion was extremely slow in some cases, or that it was sometimes prevented.

He argued that the continuity of condition between gases and liquids which had lately been so admirably illustrated made it, *a priori*, probable that similar laws prevailed in both classes of matter in respect to their laws of diffusion, &c., and that, as in the case of liquids, the law of diffusion was not a universal one, but had at least apparent exceptions, so also among gases there might occasionally be conditions which resisted or very greatly impeded the operation of the law. He granted at once that the gases that form air, and many others, bear uniform testimony to the correctness of the generalisation; but in the case of carbonic acid, watery vapour, and hydrogen, there seemed to be some room for doubt. The fact that in all abandoned wells, tunnels, and mines, where atmospheric currents do not play, and where there is no absorbing vegetation, there is an accumulation of carbonic acid gas, although these hollows have ample access to the air, goes to show that the rate of diffusion must be exceedingly slow in these cases, if in fact diffusion be not actually suspended. The mephitic vapours in low valleys in volcanic districts, and the gases that generate malaria in many low-lying marshy districts—such as the Maremma in Italy, the neighbourhood of Montpellier in France, &c.—seem to point in the same direction. The very diverse condition in regard to the amount of watery vapour contained in contiguous areas of the atmosphere, whether we examine it in different neighbouring localities or in the superimposed strata of air in any particular locality, show that the working of the law of diffusion is here greatly impeded. In regard to hydrogen the evidence is somewhat different. It is clear that if under certain conditions hydrogen be an exception to the general law of the diffusion of gases, and follows rather the more general law of gravitation, that it will exist in a stratum above the atmosphere and beyond the reach of direct observation. In his experiment upon the occlusion of gases Mr. Graham examined several *aërolites*, and found that under the air-pump they parted with a very large quantity of occluded hydrogen. If, as is probable, the gas was occluded by the *aërolites* when at a red heat, and this red heat was coincident with their passage through that layer of the upper atmosphere in which the phenomena of shooting stars and of the aurora occur, it seems more than probable that this stratum is a layer of hydrogen. This is confirmed by what we know of the spectrum of certain auroras, which resembles those of the zodiacal light and the solar corona. The spectrum of the corona has been the most attentively studied, and Janssen, perhaps the greatest authority on it, speaks most confidently about its distinguishing feature being the hydrogen lines, while a special line which characterises both its spectrum and that of aurora, and which is different to that of any terrestrial substance, is considered by Father Secchi to be an abnormal hydrogen line. Dr. Dalton long ago argued, as Mr. Baxendell has reminded Mr. Howorth, that the peculiar features of the aurora could best be explained by the hypothecation of a stratum of some peculiar gas above the atmosphere. A gas of a "ferruginous nature" is the expression of Dr. Dalton. Now hydrogen in the higher chemistry is not only classed among the metals, but Faraday and others have shown that in its relation to magnetism it is nearly allied to iron, so that a stratum of hydrogen above the air would seem to exactly answer Dr. Dalton's postulate. If it should exist, the earth would resemble the sun in one remarkable feature, for we now know that the sun is girdled with an immense layer of hydrogen. Lastly, he would add that the heterogeneous texture of the gaseous nebula, like the great nebula in Orion, seems to argue that the law of the equal diffusion of gases does not prevail there.

Mr. Howorth presented these facts with considerable hesitation, his excuse for doing so being his view that all physical laws are tentative only; that is, they are good as long as they explain all the facts, and no longer, and that it sometimes becomes a duty to present apparently aberrant and abnormal facts to an audience so well quali-

fied to criticise them as the Manchester Literary and Philosophical Society, in order that they may either be brought within the law or that the law may be revised.

NOTICES OF BOOKS.

Alkali Act, 1863. Tenth Annual Report by the Inspector of his Proceedings during the year 1873.

DR. R. ANGUS SMITH has presented the authorities and the nation with another of his most instructive reports on the working of the Alkali Act. Whilst pointing out the very satisfactory circumstances that "the work" (condensation of muriatic acid gas) is gradually being done with more exactness, he thinks that the time is come when the Act may be improved without injury to the manufacturers, and with manifest benefit to the general public. The law at present requires that a certain percentage of the gas generated,—as calculated from the salt decomposed,—shall be condensed, but takes no note of the degree of concentration or dilution of the remaining portion. Dr. Smith suggests, therefore, that an additional standard shall be enforced, to the effect that the gaseous mixture escaping from the chimneys "shall not contain above a certain amount of acid per cubic foot." The present average is found to be 0.16 grain per cubic foot. The Inspector has reasons for believing that the evil is done chiefly by those above this average, and proposes that a maximum of 0.2 grain shall be adopted, "to be diminished gradually by the Local Government Board, as circumstances showed it practicable, by 0.02 at a time and annually till it reached 0.1." He suggests also that the other gases, *e. g.* sulphurous acid, oxides of nitrogen, &c., shall be put under inspection, and their treatment by the best known methods demanded. To these proposals no reasonable objection can be raised. The original Act was tentative, and having succeeded to a certain extent, we are encouraged to go further. If we take the whole kingdom into consideration, there can be no doubt that sulphurous acid, as evolved from imperfectly managed lead chambers, from roasting sulphuretted ores, from "stoving" woollen goods, and most of all from the combustion of coal, does far more mischief to vegetation than the merely local escape of hydrochloric acid. It is, therefore, of the highest importance that serious attempts should be made for the abatement of the nuisance. Something has already been done. Many metallurgical establishments which formerly allowed the whole of the sulphurous acid evolved to escape into the air, now convert a part at least into sulphuric acid. The most striking result on record is that obtained at Mulden, near Freiberg. There, in 1864, only 18,000 cwts. of sulphurous acid were converted into sulphuric acid. But now the proportion has risen to 49,320 cwts. converted into sulphuric acid, or 42 per cent. of the gross amount. Dr. Smith informs us that he has not "heard of any equal result obtained in England at any metallurgic works."

But the main amount of sulphurous acid evolved is due merely to the combustion of coal in dwelling-houses and manufactories, and we feel, therefore, bound to ask if nothing is to be done in this direction? It is instructive, in this respect, to compare the atmospheres of London and of Manchester. We have smoke enough in the metropolis, but the trees in our parks and squares are luxuriant in comparison with the vegetable hobgoblins withering in the outskirts of the northern city. "The air of Manchester," says our author, "will allow no plants to grow. I am persuaded that it is the acid that is the main cause." The reason of the excess of acid in the air of Manchester is that the Lancashire coal is very rich in sulphur. Now it is obvious that smoke consumption, commonly so-called, cannot reduce the evil. The more perfectly we burn a ton of coal, the more certain it is that all the sulphur present is oxidised. Our only hope lies in minimising the consumption. If we find that one steam-engine proprietor

can obtain a certain amount of power with a certain consumption of coal while his neighbour requires only half the quantity, we must compel the former to do likewise.

The results quoted from Prof. Stockhardt and the members of the Saxon commission appointed to examine the action of metallurgical fumes upon agriculture are very interesting. They find that "the trees first injured are the conifers; then the willow and the birch; acacias, alders, and oaks stand better, and still more the poplars and elms. Among fruit trees the sweet cherry, nut (probably walnut), and plum trees go early; the apple remains longer; pear and mulberry trees stand still better. Among bushes the order is whitethorn, rose, currant, and vine; the gooseberry and raspberry suffer less, and the mulberry hedge, quince, privet, and elder suffer least." This comparative order agrees pretty well with what has been observed in England. The inability of the rose to tolerate a smoky atmosphere is well known.

For further valuable information as to the effects of sulphurous acid and coal smoke in general upon vegetation we must refer our readers to the report itself.

The influence of the fumes of chemical works upon animal—and in particular upon human—life, has also been made the subject of enquiry. Dr. Smith has been unable to find satisfactory evidence in favour of the not uncommon notion, that acid vapours are a protection against zymotic diseases and against certain pulmonary affections.

In conclusion we feel bound to give our hearty testimony to the value of the services which Dr. Smith, in his capacity as inspector under the Alkali Act, is rendering to the nation. If the Act is successful the result is mainly due to his zeal, tact, and intelligence. His method has been to lead, not drive, the interests affected. He does not seek to lay down at once a hard and fast line, but as a truly practical man he aims at and effects gradual improvement. We can wish nothing better for the cause of sanitary reform than that all inspectors who have to deal with "standards" may sit at his feet.

Des Produits tires du Pin Maritime. Essai theorique et pratique sur la Fabrication des Matieres Resineuses.
Par PAUL CURIE. Paris: Eugene Lacroix.

AN interesting account of the products obtained from the maritime pine of the Landes of south-western France. Among these the author enumerates, besides timber and charcoal, acetic acid, wood-spirit, tar, illuminating gas, cellulose, applicable in the paper manufacture, oil, fat, crude turpentine, essences, rosins, pitch, resinous oils, and lamp-black. Some of these products are complex mixtures not as yet thoroughly examined, either from a theoretical or a practical point of view. To these the author especially calls the attention of chemists, as it is far from improbable that they may prove capable of new and important applications.

The processes at present in use for obtaining the products above mentioned are carefully described, and the work is accompanied with illustrations of plant and apparatus, and with a map of the district. One coloured plate shows the successive shades of resins and pitches from "extra-resin" of the palest straw-yellow, bordering upon white, to the *brui-noir*, black pitch, of an earthy-brown colour. From colophene—a liquid remarkable for its dichroism—he suggests the possibility of obtaining colouring matters.

The Journal of Materia Medica. Conducted by J. BATES, M.D., and H. A. TILDEN. New Lebanon, N.Y.: Tilden and Co.

THE most interesting point in this little journal is a statement by Dr. Duff Child that malaria is a definite chemical compound, consisting of carbon, nitrogen, and hydrogen, and capable of existing free or combined. The editors, like ourselves, feel somewhat sceptical as to this new theory, and would like further evidence.

CORRESPONDENCE.

COMMERCIAL ANALYSES.

To the Editor of the Chemical News.

SIR,—The curt letter (CHEMICAL NEWS, vol. xxx., p. 294) in which Messrs. Pickford and Winkfield complain of discrepancies between certain analyses, gives us no assurance of the identity of the samples submitted to A, B, and C. The accordance which might be expected between the results of analysis can only be judged of when the means are known which were taken to render the mass furnishing the samples perfectly homogeneous. The case would also have been more fully presented to your readers if Messrs. Pickford and Winkfield had stated what fees A, B, and C received for the analyses in question. The fees paid for commercial analyses are often such as to make it simply impossible for the analyst to attempt scientific accuracy. None but persons who have themselves worked at exact chemical determinations have any idea of the amount of delicate manipulation, exact observation, time, and patience required for an accurate and complete analysis of such substances as those referred to in your correspondents' letter. If fees are paid which entirely put out of the question the expenditure of all this time and attention, rough and ready methods are necessarily adopted. Such methods usually suffice for commercial requirements, and although even these imply on the part of the chemist skill acquired only by long training, the remuneration he receives is absurdly small when compared with that earned in other professions. It appears to me that the means to be taken to prevent the "frightful discrepancies" complained of are very obvious and entirely in the power of the commercial world. When the analyst's fees are made at least equal to those paid to the accountant, the actuary, or the lawyer, for a comparable amount of skill and attention, we shall hear no more pathetic laments over losses through the inaccuracies of chemical analysis.—I am, &c.,

R. ROUTLEDGE.

London, December 30, 1874.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 22, November 30, 1874.

Distribution of Bands in Primary Spectra.—M. G. Salet.—The question of the existence of double spectra seems at present answered in the affirmative. A few years ago the Swedish physicist, Angström, in his celebrated memoir on the solar spectrum, pronounced the opinion of Plücker, according to which an elementary body might give different spectra at different temperatures, decidedly incorrect. Yet in his last work he declares himself unwilling to deny that a simple body, when brought to the gaseous state by heat, may not, in some cases, give different spectra. An element may form with another element a chemical compound giving a particular spectrum, and in like manner the same element may form compounds with itself—isomeric compounds which, if not destroyed by heat, may give each its peculiar spectrum. This is the opinion which the author has maintained, supporting it by various experiments made, not only with Geissler's tubes, but also taking advantage of the absorbent properties of certain vapours, such as sulphur, bromine, and iodine. The spectra with bands, or primary spectra of the simple bodies, seem absolutely similar to the known

absorption-spectra; those, for example, of iodine and bromine, which no one has thought of ascribing to compounds. The author has to point out a new point of resemblance between these two sorts of spectra. It is known that Thalen, in a work on the absorption-spectrum of the vapour of iodine, has concluded that the various bands of this fluted spectrum are not equidistant; they form several intermingled series, and in each of these the respective distance of the consecutive bands varies with the length of the wave, following a law which differs little for adjacent series. The study of the primary spectrum of sulphur has led the author to similar conclusions.

Letter of M. Schnetzler to M. Dumas on Viticulture.

Letter of M. Max Cornu to M. Dumas on Viticulture.

Heat Disengaged by the Combination of Hydrogen with Metals.—M. J. Moutier.—M. H. Sainte-Claire Deville, comparing the phenomenon of dissociation with that of evaporation, has indicated the course to be taken in the application of thermo-dynamical formulæ to the study of dissociation. The formula deduced by Clausius from Carnot's theorem for changes of aggregate condition applies to dissociation. If we call L the heat of combination of two bodies of the absolute temperature, T , under the pressure, p , equal to the tension of dissociation of the resulting compound at this temperature; v the specific volume of the dissociated elements; v' the specific volume of the compound in the same conditions of pressure and temperature; A the calorific equivalent of the work done, then—

$$L = AT(v - v') \frac{dp}{dT}$$

This formula permits us to determine the heat of the compound L , when we possess a table of the tensions of dissociation of the compound at different temperatures. The heat liberated by the combination of hydrogen with potassium and sodium increases at first with the temperature and then decreases, so that the heat of combination of hydrogen with the alkaline metals passes its maximum within the limits of the temperatures observed. The combination-heat of hydrogen with sodium is notably superior to that of hydrogen with potassium. At a temperature of 330° , calculation gives for potassium $L = 9300$ calories, and for sodium $L = 13000$ calories.

Laws of Double Interior Reflection in Bi-refrangent Uniaxial Crystals.—M. Abria.—If the two rays, ordinary and extraordinary, into which a ray of light is divided when it enters a double refractive prism, are reflected by one of the lateral faces, each of them is split up by the act of reflection, and we obtain in general four images. The theory of undulations permits us to determine the direction of each of these reflected rays, and the author has undertaken to verify the laws to which it leads. In the case first examined, the axis of the quartz prism was parallel to one of the planes, and, moreover, perpendicular to the edges. The ray falling upon the plane of entrance normally to that plane gives two rays, but each of the latter only furnishes one by reflection. One of them has undergone the ordinary refraction and reflection, and the other the extraordinary. They may be designated OO' , EE' . The author has calculated according to the theory the angle which the definitive emergent rays should form with each other, and has compared it with that found by observation. The agreement is complete.

Decomposition of Certain Salts by Water.—M. A. Ditte.—(See *Comptes Rendus* for October 19 and 24, 1874.) The author has experimented on the double sulphate of potash and lime, $2(\text{SO}_3, \text{CaO}), \text{SO}_3\text{KO}, 3\text{HO}$. He comes to the following general conclusions:—The salts examined are decomposed by water, according to laws well known and alike in all cases. There is formed a sparingly soluble product (a sub-salt, or sulphate of lime), and the water takes up free acid or sulphate of potash. For each

temperature there exists a liquid of such composition that according as the concentration is varied in one or other direction there takes place either decomposition or re-constitution of the primitive salt; and whatever may be the point of departure, the direction of the phenomenon is always such that the liquid returns to this composition. The decomposition appears independent of the quantity of undecomposed salt which the liquid contains, of the undissolved quantities of its elements which are there found in a state of mixture, and also of the nature of the acid or saline substances which it may contain if these substances have no chemical action upon the salt in question or upon its constituents. It may not be without interest to bring these results into connection with the laws established by M. Sainte-Claire Deville for the dissociation of bodies by heat, laws which seem applicable to these phenomena. We need not be surprised at this analogy if we compare the action of heat and that of a solvent upon the same compound. The quantity of heat needful to produce a change of state is always the same whether this change takes place in the hot way or in the way of solution. It appears, therefore, natural that certain decompositions may be effected by the direct action of fire, or by the intermediation of a liquid, following analogous rules in both cases.

Product of Addition of Propylen to Hypochlorous Acid.—M. L. Henry.—Noticed elsewhere in the CHEMICAL NEWS.

Influence of Boiling Distilled Water upon Fehling's Test.—MM. E. Boivin and D. Loiseau.—Pure distilled water to which are added 20 c.c. of Fehling's test per litre, decolourises this liquid after boiling for a few minutes. No decolouration is observed under the same circumstances if a very small quantity of a calcareous salt, *e.g.*, chloride of calcium, be previously added. This is an important precaution in the determination of small quantities of non-crystallisable sugar by Barreswill's method. Conversely, to ascertain the purity of distilled water, 50 c.c. may be boiled with 1 c.c. of Fehling's test.

Stony Concretion.—T. L. Phipson.—This calculus consists of xanthic oxide, uric acid, oxalate of lime, and phosphate of lime.

Bulletin de la Societe Chimique de Paris,
Nos. 8 and 9, November 5, 1874.

Relations which Exist Between the Atomic Formulæ of Organic Bodies and the Rotatory Power of their Solutions.—J. A. Le Bel.—The author lays down the following general principle:—Let us consider a molecule of a chemical compound having the formula MA_4 . M is a simple or complex radical combined to four monatomic atoms A, capable of being replaced by substitution. Let us replace three of them by monatomic radicals, simple or compound, differing among themselves and not identical with M. The body obtained will be dissymmetric. In fact the totality of the radicals R, R', R'', and A, assimilated at material points, differing among themselves forms a structure not capable of being superimposed on its image, and the residue M cannot re-establish symmetry. Then, in general, if a body is derived from our primitive type, MA_4 , by substituting for A_3 three distinct atoms or radical, its molecule will be dissymmetrical, and it will have rotatory power. (Second general principle.)—If in our fundamental type we substitute only two radicals, R and R', there may be symmetry or dissymmetry according to the constitution of the type-molecule, MA_4 . If this molecule has a symmetrical plan, without regarding the two atoms which have been replaced by R and K, this plan will remain symmetrical after the substitution, and the body obtained will be optically inactive.

Swedish Correspondence, September 25, 1874.—M. P. T. Clève.—M. N. O. Holst has studied certain double cyanides of platinum. Thalen has published in the

Transactions of the Academy of Sciences of Stockholm vol. xii., No. 4, a detailed work on the spectra of yttrium, erbium, didymium, and lanthanum. A. Atterberg has investigated boracic acid and certain borates. Olof Hammarsten has examined the coagulation of milk, proving that milk-sugar has no influence on the coagulation of milk by rennet. He throws down milk with chloride of sodium, re-dissolves the precipitate in water, and separates the butter by agitation; precipitates the casein a second time with chloride of sodium, and re-dissolves in water. He thus obtains a solution of casein free from sugar of milk, and which coagulates with rennet like milk. This coagulation cannot be due to lactic acid, and must be owing to a ferment in the rennet. The solution of the pure ferment does not yield the xantho-proteic reaction. It is not precipitated by nitric acid, alcohol, iodine, tannic acid, and neutral acetate of lead, but by the subacetate. Ebullition destroys its activity without coagulation. This ferment is soluble in water, glycerin, and saline solutions. Its solutions do not pass through membranes by diffusion. Alcohol destroys the ferment in course of time. The membrane of the stomach of all animals contains a soluble matter, which is not the rennet ferment, but which is converted into it by lactic or hydrochloric acid. The author has found that the membrane of the stomach, besides pepsine and this body, contains a third ferment which converts milk-sugar into lactic acid. M. Haldor Topsoe has described the crystalline forms of the platino-cyanides of didymium, cerium, lanthanum, erbium, yttrium, and thorium; the chloro-platinates of cerium; the double salts formed by mercurous chloride with the sulphocyanides of lanthanum, cerium, yttrium, erbium, didymium, and calcium; the hyposulphate of didymium; the sulphate of lanthanum; the seleniates of yttrium, erbium, didymium, and thorium; and other salts of the same group of metals. Otto Petterson has produced a memoir on the molecular volumes of certain series of isomorphous salts.

Correspondence from St. Petersburg, September 1 to 12, 1874.—M. W. Louguinine.—In the sixth fascicule of the *Journal of the Russian Chemical Society* M. Potylitzine gives a preliminary communication on the reciprocal displacement of the haloids. M. Gazarine makes known the preliminary results of a study of the isomers, C_2H_4BrI . MM. Popoff and N. Ley communicate the results of their researches on the oxidation of the oxacids of the fatty series. M. Prutz gives an analysis of the waters of Lake Aral, which resemble in composition those of the Caspian. M. Mendeleef describes a pump which he has constructed without taps or valves, and requiring very little mercury. It is founded on the vacuum produced by the descending movement of a vessel containing mercury. M. Goldstein communicates the results of his investigations on the oxidation of volatile nitro-phenol by the permanganate of potash. M. A. P. Dianine contributes a memoir on the products of the oxidation of the naphthols by means of perchloride of iron. M. P. Goloubieff has investigated dinitrazo-benzoic acid; and M. N. Tawildaroff has been engaged with the combination of bromide of acetyl with aldehyd.

Moniteur Scientifique, du Dr. Quesneville,
November, 1874.

Applications of Indigo in Dyeing and Printing.—M. A. Schultz.—A valuable practical paper, collating the methods used in some of the first dye and print works, both on the Continent and in this country. If possible it will be inserted in full.

Conditions of the Formation of Octahedral Borax.—M. D. Gernez.—This paper has been noticed elsewhere.

New Class of Explosive Matters.—Dr. Hermann Sprengel.—The author proposes a variety of explosive mixtures, such as nitro-benzine with nitric acid, a com-

pound which he considers more powerful than gun-cotton, or dynamite.

Natural Philosophy in England and in France.—J. M. Guardia.—A comparison of the state of science in England and in France, in which the author awards the palm of superiority to our country. The immediate occasion of his remarks is the Belfast speech of Dr. Tyndall, which he eulogises with great fervour. The following passage is not without interest:—"We have an official science, an official religion, an official instruction; in other terms, a science, a religion, an instruction which are those of the majority. Add to these the armed forces and the magistracy, and you have the five classes of state (compare the five classes of the Institute of France) forming the formidable body of the French mandarinat. Reflect a little, friend reader, on the profound combinations of this Chinese mechanism; on the conditions of existence of this quintuple hierarchy; on the indefinite effects of this Gallo-Roman organisation. Evoke the shades of the great Napoleon, of Cuvier the orthodox, of Guizot the infallible, and you will not fail to comprehend the etiology and the pathogenesis, as the physicians say, of this chronic malady which we will call alethophobia, or in French the fear of truth,—a malady whose chief symptom is hypocrisy."

Solubility of Phosphates.—M. Jules Joffre.—The author considered it important to make some researches on the action of carbonate of lime upon soluble phosphate, and upon the influence of various bodies in preserving the solubility of phosphates in presence of the carbonate of lime. In France it is generally admitted that the soluble phosphate of all manures is immediately rendered insoluble under the influence of the carbonate of lime found in arable soils. From the author's experiments it appears that these views require to be considerably modified when certain substances are present. The acid phosphate of lime ($\text{CaO}, \text{PO}_5, 2\text{HO}$) brought in contact with carbonate of lime in excess and with much water loses its solubility. But this reaction is not instantaneous; a certain amount of time is required and a small portion of the phosphate remains for a long time soluble. The same phenomena occur when, instead of pure acid phosphate of lime, we take a superphosphate containing mineral matters only. But if certain substances are added the result may be very different. The author placed 0.11 grm. of phosphoric acid, in the state of acid phosphate, in contact with 4 to 5 grms. of carbonate of lime, and left them for some days. In these conditions, and if no other substance is added, there remained, after the lapse of a few days, only 0.014 grm. of soluble phosphoric acid, or 21.8 per cent. On adding oxalate of lime there remained, after an equal time, 0.043 soluble, or 39.1 per cent. On adding sulphate of ammonia there remained 30.9 per cent; and on adding oxalate of ammonia there remained 68.2 per cent. A mixture of oxalate of lime and sulphate of ammonia acted like oxalate of ammonia. The author finds also that phospho-guanos, *i.e.*, guano rendered soluble by the addition of sulphuric acid, preserve their solubility much better than super-phosphates, owing doubtless to the organic matters, and especially to the oxalic acid which guano contains.

MISCELLANEOUS.

Exhibition of Appliances for the Economy of Labour, 1875.—The Council of the Society for the Promotion of Scientific Industry, the head-quarters of which are at Manchester, has decided to give gold, silver, and bronze medals for excellence and novelty in the various classes of exhibits at the Exhibition of Implements, Machines, and Appliances for the Economising of Labour, which is to take place in Manchester in 1875. The arrangements for the Exhibition are progressing satisfactorily, and space has been secured by many high-class engineering and other firms.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved process for treating madder for obtaining and separating alizarin and purpurin therefrom. Hector Auguste Dufrené, Rue de la Fidélité, Paris. (A communication from Jules Pernod, Avignon, France.) March 27, 1874.—No. 1074. Madder, flowers of madder, garancin, or other derivative from madder reduced to powder, is treated with a solution of sulphate of alumina, and, after boiling and filtering, sulphuric acid is added to the liquid which precipitates the purpurin. The ligneous residue is treated with sulphuric acid, water is added, and the temperature raised to about 212°F . The mass is then washed over a filter.

Improvements in the treatment of waste or refuse animal or nitrogenous matters, for the purpose of producing fertilising substances or artificial manures. William Crookes, F.R.S., Morningson Road, Regent's Park, Middlesex. April 2, 1874.—No. 1152. In carrying out my invention I take fish, flesh, or other putrescible animal matters, and after cutting up or reducing the substance to a divided state, I steep it if necessary in any convenient liquid compound possessing antiseptic, deodorising, or disinfecting properties; or I sprinkle such liquid over the solid matters. I then place the mass in a hydro-extractor, or other suitable apparatus, for the purpose of driving off and separating the liquid matters from the solid.

A new or improved anti-fouling composition or paint. Elias Jones, paint manufacturer, Swansea, Glamorgan, and Andrew Howatson, mechanical engineer, Cronberry, Auchinlech, Ayr, N.B. April 4, 1874.—No. 1173. The novelty of the invention consists in producing an anti-fouling composition or paint by mixing together dissolved American resin and melted mutton suet with oxide of zinc, prepared chalk, carbonate of lead, and arsenic in given proportions; and then grinding the whole together, and applying it to the surface to be coated whilst hot.

Improvements in thermo-electric piles. Charles Clamond, engineer, Boulevard de Strasbourg, Paris. April 6, 1874.—No. 1199. This invention relates to—First. A method of sealing or of separating thermo-electric negative plates. Second. The formation of thermo-electric bars in a mould previously heated almost to the point of fusion of the thermo-electric substance. Third. An arrangement for heating by gas according to the construction of the apparatus to permit of the employment of a cylindrical Bunsen or atmospheric burner, with a supply of additional air from the outside. Fourth. Building up and binding the pile proper between two ring plates united by bars and rods. Fifth. A special arrangement for heating by coke by the aid of a radiating cylinder of a movable bar, and of a feed receiver.

An improved method of treating tobacco to free it from nicotine and ammonia. Henry Woodcroft Hammond, civil engineer, Southampton Buildings, Chancery Lane, London. (A communication from Charles Augustus Weigold, Reudnitz, Saxony.) April 9, 1874.—No. 1227. This invention relates to an improved process of preparing a chemical conserve tobacco free from nicotine and ammonia; and consists in allowing steam to pass through a hermetically closed vessel to soften the tobacco, when by means of Bequereux air rarefaction apparatus connected with said vessel, all the nicotine, ammonia, and air are extracted from the tobacco and the vessel containing it. To replace the deleterious properties of the nicotine and ammonia, and give to the tobacco an agreeable aroma, the prepared and combined extracts of either of the following ingredients or receipts are added to each cwt. of tobacco, *viz.*:—First. 8 litres of water, 2 litres of beer, $\frac{1}{2}$ lb. of green tea, $\frac{1}{2}$ lb. ground plum kernels, 10 grms. of fine honey, 5 grms. of rose leaves, 1 grm. of vanilla, 6 grms. of peppermint, and 1 lb. of juniper berries. Or, secondly, 10 litres of water, 2 grms. of cardamon, 3 grms. of ginger, 2 grms. of lavender flowers, 2 grms. of galangel, 2 grms. of reseda oil, 25 grms. of currants, 50 grms. of plum kernels, 1 lb. of juniper berries. Or, thirdly, 10 litres of water, 2 grms. of cardamon, 3 grms. of ginger, 2 grms. of lavender flowers, 2 grms. of galangel, 2 grms. of reseda oil, 25 grms. of currants, 50 grms. of plum kernels, 1 lb. of juniper berries. These prepared ingredients are allowed to simmer with the tobacco for three hours, when the tobacco is taken out of the vessel and dried, and made ready for use.

MEETINGS FOR THE WEEK.

MONDAY, Jan. 4th.—Medical, 8.

London Institution, 5.

TUESDAY, 5th.—Royal Institution, 3. Professor Gladstone, "On the Voltaic Battery." The History of the Battery in its Various Forms. (Juvenile Lecture.)

Zoological, 8 $\frac{1}{2}$.

WEDNESDAY, 6th.—Microscopical, 8.

THURSDAY, 7th.—Royal Institution, 3. Professor Gladstone, "On the Voltaic Battery." Electrotyping &c. (Juvenile Lecture.)

Royal Society, 8 $\frac{1}{2}$.

London Institution, 7.

SATURDAY, 9th.—Royal Institution, 3. Professor Gladstone, "On the Voltaic Battery." The Electric Telegraph. (Juvenile Lecture.)

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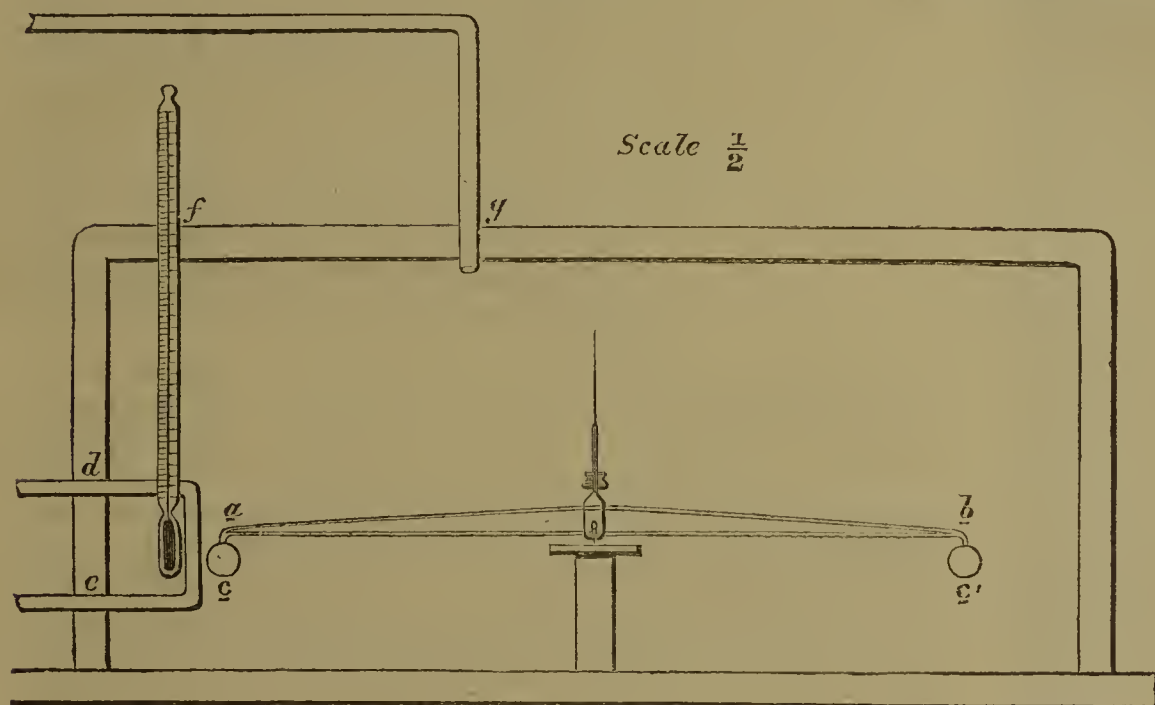
ON ATTRACTION AND REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from page 2.)

18. A LIGHT beam (*a b*, Fig. 1) was made of two pieces of fine flattened brass wire 120 millims. long, 5 millims. apart at the point of suspension, and joined together at each end. A pair of very fine needle-points, one on each side of the beam, represented knife-edges, and worked on glass plates cemented horizontally to upright pillars. The centre of gravity could be altered by a screw, and a pointer

FIG. 1.



projecting upwards enabled me to see a movement of the beam. A brass ball (*c, c'*) 6 millims. diameter, was soldered to each end of the beam. The balance was adjusted so that it made one oscillation in about five seconds.

19. The case consisted of a rectangular box of brass, 10 m.m. thick, the front of which was replaced by plate glass. At one end two holes were drilled (*d, e*) about 20 mm. apart, and a curved piece of glass tube was cemented in, so that both ends were outside. At the top a hole (*f*) was drilled to receive a thermometer, and another (*g*) to receive the tube attaching the instrument to the Sprengel pump. By sending a current of hot water through the bent glass tube, heat could be communicated to one of the brass balls, and the movement, if any, of the beam could be seen by a micrometer in front. Many experiments were tried with this apparatus, and the result appeared to be that warming the ball caused it to sink (49). This action might, however, be due to the expansion of the brass beam by heat; so to obviate this source of error, I sought for a material wherewith to make a beam which should be as little affected as possible in this manner.

20. A stick of fine-grained charcoal was worked up into the shape of a beam, and fitted at each end and in the centre with appropriate metallic collars for the needle-points and brass balls. To get rid of absorbed gases, which experience showed were evolved unequally in a

vacuum, and thereby threw the beam out of adjustment, it was first heated strongly in an exhausted tube, and then soaked in an alcoholic solution of shellac. When quite dry, the charcoal was heated till the shellac fused. After much difficulty the beam was adjusted, and being enclosed in the brass case described above, exhaustion was effected. With this charcoal beam I also found that heat generally caused the brass ball to sink (49).

21. These results were opposed to what I had before noticed, but many anomalies were observed (49). Thus the diminution of gravity did not appear to vary as the rarefaction increased; and the position of the hot body, in relation to the brass ball, seemed to have considerable influence on the direction and amount of movement. It was also difficult to make the brass case, with its numerous joints, sufficiently tight to hold a Sprengel vacuum,* even by painting it over with gold-size when partially exhausted, and I therefore decided to form the beam of some other material.

22. A mica beam was at first tried, but it was found to be liable to split across. Magnesium possesses the advantages of lightness and rigidity, but was inapplicable, owing to its expanding by heat. A gridiron beam of zinc and iron, or of zinc and glass, and a beam formed of two reversed thermometers, their bulbs forming the gravitating masses, were thought of, so as to have self-compensation for changes of temperature; but after a few experiments the weight of such beams was found to be an insuperable objection, even had the difficulties of adjustment been overcome. Altogether glass seemed to offer most advantages, as being sufficiently rigid, whilst its low conducting-power for heat rendered it little liable to introduce errors from expansion.

A straight glass beam was drawn from a piece of rectangular glass tube, and it was fitted with needle-point centres and brass balls at each end, similar to the plan adopted with the brass and charcoal beams. This was fitted in the small brass case, and many experiments were tried with it. The results were still anomalous, the apparent action of heat being sometimes in one direction and sometimes in another (49).

Greater delicacy was still required, and the brass balls at the end of the beam were accordingly replaced with magnesium balls; and instead of enclosing the balance in the brass case, I sealed it up, after exhaustion, in a glass tube. With this a large number of experiments were tried; but as the subsequent results, after I had discovered one of the laws governing the phenomena, were much more satisfactory, I forbear from occupying space in describing these preliminary experiments.

23. Afterwards I experimented successively with a glass beam having no special weight at the ends, and with the same beam with terminal knobs of glass fused on; this appeared to increase the delicacy somewhat, but the weight was still too great to allow of accurate results being obtained; and I finally adopted straw as the material for the beam, varying the gravitating masses at the end as experience dictated. Straw possesses many advantages: it is exceedingly light, yet rigid; it dries easily, and evolves

* From the *Philosophical Transactions of the Royal Society of London*, vol. clxiv., par 2.

* As I shall have to speak of various kinds of vacua, it will be best to name them distinctively to avoid periphrasis. I shall call the best vacuum which my air-pump will give an *air-pump vacuum*—this is one or two millimetres below the barometer. The ordinary vacuum produced by the Sprengel pump I shall call a *Sprengel vacuum*—in this the gauge is appreciably level with the barometer. A so-called “perfect” vacuum, produced by potash and carbonic acid, as subsequently described, or by similar means, I shall call a *chemical vacuum*, I object to the term *perfect*, as applied to any vacuum at present known, as I believe that where force can travel we are not justified in assuming the absence of matter—imponderable it may be, and unaffected by ordinary forms of force—but none the less *matter*.

no vapour in a vacuum; moreover, it is not likely to introduce errors by altering in shape under the influence of the moderate degrees of temperature to which it is subjected in these experiments.

FIG. 2.

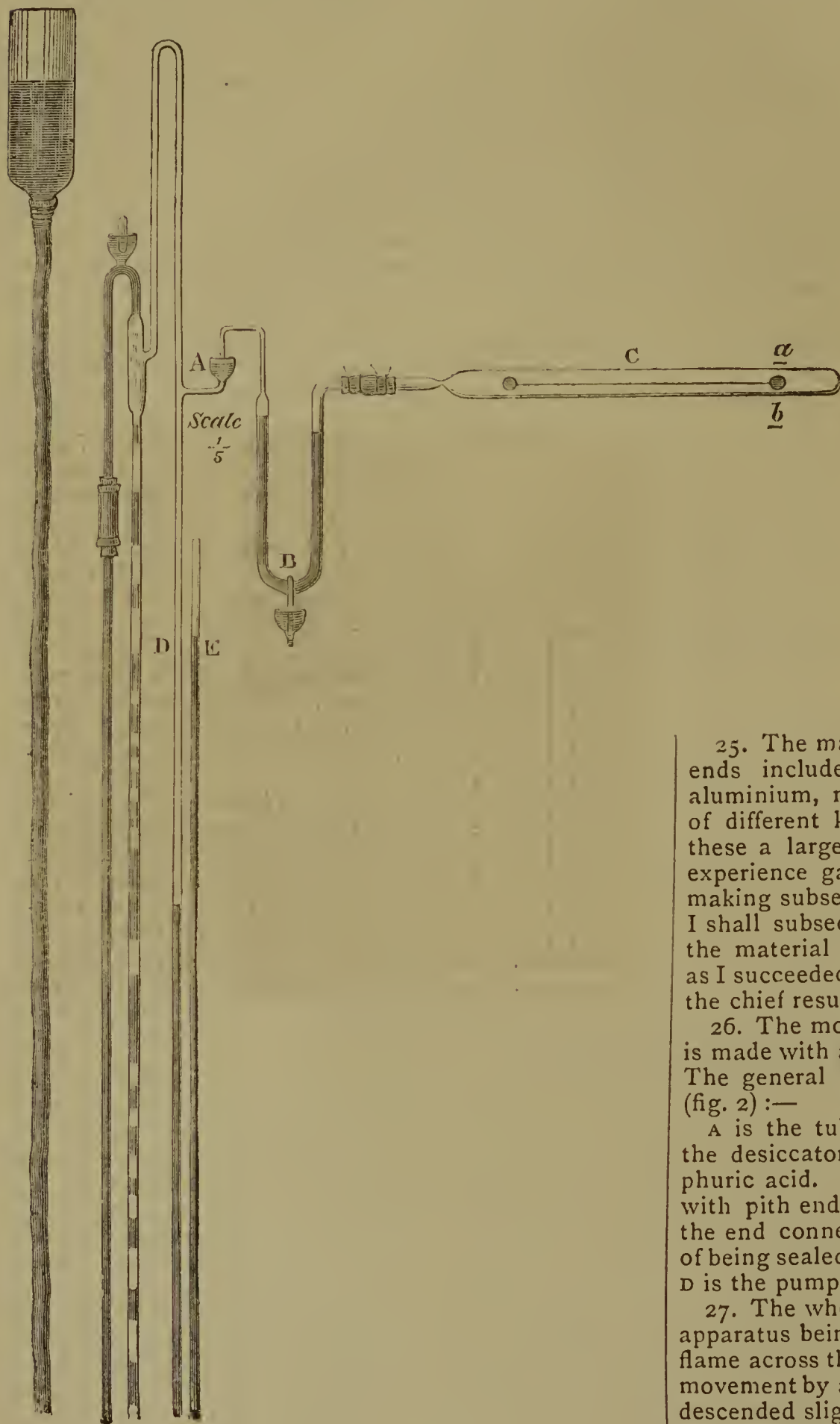
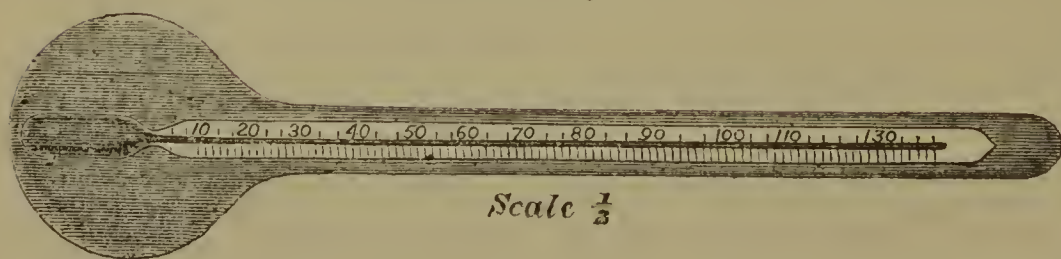


FIG. 3.



24. The method of supporting the straw beam in the centre, so as to secure the maximum sensitiveness without the liability to get out of order, was difficult at first.

After trying suspension by fibres of cocoon-silk from a glass frame, suspension on a fine glass axis resting on thin glass rods, and many other devices, I finally adopted the following mode of support:—

The pointed half of a small sharp needle is broken off about half a millimetre shorter than the internal diameter of the glass tube; the blunt end is then ground very sharp on Arkansas stone. The straw, about seven inches long, having its gravitated masses at the ends, is then balanced on a knife-edge so as to let it roll over to a stable position and to find its centre; and the needle is then run through it at right angles, at such a distance above the horizontal centre of the straw that the centre of gravity of the whole system is a little below the centre of suspension. The beam being slipped into the glass tube (sealed at one end), the needle is supported very delicately against the sides of the glass by its points, and with the least possible amount of friction. It is best now to exhaust temporarily, heating the straw by passing a spirit-flame along the tube, so as to drive off moisture. If, as is almost certain to be the case, one end becomes heavier than the other, equilibrium can be restored, without much difficulty, by holding the spirit-flame for a few seconds under the heavier end, so as to slightly char the straw or other material. When in good adjustment and sufficiently sensitive the balance is ready for experiment.

25. The material with which I form the masses at the ends includes platinum, brass, silver, lead, bismuth, aluminium, magnesium, glass, selenium, ivory, charcoal of different kinds, straw, cork, and pith. With each of these a large series of experiments were tried, and the experience gained with each was turned to account in making subsequent apparatus.* Certain differences, which I shall subsequently allude to, were noticed according to the material forming the gravitating mass; but as soon as I succeeded in obtaining the requisite degree of delicacy, the chief results were as decided as they were unexpected.

26. The most delicate apparatus for general experiment is made with a straw beam having pith masses at the end. The general apparatus is shown in the annexed figure (fig. 2):—

A is the tube belonging to the Sprengel pump.† B is the desiccator, full of glass beads moistened with sulphuric acid. C is the tube containing the straw balance with pith ends. It is drawn out to a contracted neck at the end connected with the pump, so as to readily admit of being sealed off if desired at any stage of the exhaustion. D is the pump-gauge, and E is the barometer.

27. The whole being fitted up as here shown, and the apparatus being full of air to begin with, I passed a spirit-flame across the lower part of the tube at b, observing the movement by a low-power micrometer; the pith ball (a b) descended slightly, and then immediately rose to considerably above its original position. It seemed as if the true action of the heat was one of attraction, instantly overcome by ascending currents of air. A hot metal or glass rod and a tube of hot water applied beneath the pith ball at b produced the same effect as the flame; when ap-

* It is only fair to acknowledge here the assistance which I have received during the progress of these experiments from my young friend and pupil, Mr. Charles H. Gillingham. Without his skill with the blow-pipe and delicacy of manipulation with complicated

apparatus, it would have been difficult for me to have carried out this investigation during the limited time I am able to devote to original research.

† For a full description of this pump, with diagrams, see *Phil. Trans.*, 1873, vol. clxiii. p. 295.

plied above at *a*, they produced a slight rising of the ball. The same effects take place when the hot body is applied to the other end of the balanced beam. In these cases air-currents are sufficient to explain the rising of the ball under the influence of heat.

28. In order to apply the heat in a more regular manner, a thermometer was inserted in a glass tube, having at its extremity a glass bulb about $1\frac{1}{2}$ inches diameter; it was filled with water and sealed up (see fig. 3). This was arranged on a revolving stand, so that by means of a cord I could bring it to the desired position without moving the eye from the micrometer. The water was kept heated to 70°C ., the temperature of the laboratory being about 15°C .

29. The barometer being at 767 millims. and the gauge at zero, the hot bulb was placed beneath the pith ball at *b*. The ball rose rapidly. As soon as equilibrium was restored I placed the hot-water bulb above the pith ball at *a*, when it rose again, more slowly, however, than when the heat was applied beneath it.

30. The pump was again set to work; and when the gauge was 147 millims. below the barometer, the experiment was tried again; a similar result, only more feeble, was obtained. The exhaustion was continued, stopping the pump from time to time to observe the effect of heat, when it was seen that the effect of the hot body regularly diminished as the rarefaction increased, until, when the gauge was about 12 millims. below the barometer, the action of the hot body was scarcely noticeable. At 10 millims. below it was still less; whilst when there was only a difference of 7 millims. between the barometer and the gauge, neither the hot-water bulb, the hot rod, nor the spirit-flame caused the ball to move in an appreciable degree.

The inference was almost irresistible that the rising of the pith was only due to currents of air, and that at this near approach to a vacuum the residual air was too highly rarefied to have power in its rising to overcome the inertia of the straw beam and the pith balls. A more delicate instrument would doubtless show traces of movement at a still nearer approach to a vacuum; but it seemed evident that when the last trace of air had been removed from the tube surrounding the balance—when the balance was suspended in empty space only—the pith ball would remain motionless, wherever the hot body were applied to it.

31. I continued exhausting. On next applying heat, the result showed that I was far from having discovered the law governing these phenomena; the pith ball rose steadily, and without that hesitation which had been observed at lower rarefactions. With the gauge 3 millims. below the barometer, the ascension of the pith when a hot body was placed beneath it was equal to what it had been in air of ordinary density; whilst with the gauge and barometer level its upward movements were not only sharper than they had been in air, but they took place under the influence of far less heat—the finger, for example, instantly repelling the ball to its fullest extent.

To verify these unexpected results, air was gradually let into the apparatus, and observations were taken as the gauge sank. The same effects were produced in inverse order, the point of neutrality being when the gauge was about 7 millims. below a vacuum.

(To be continued.)

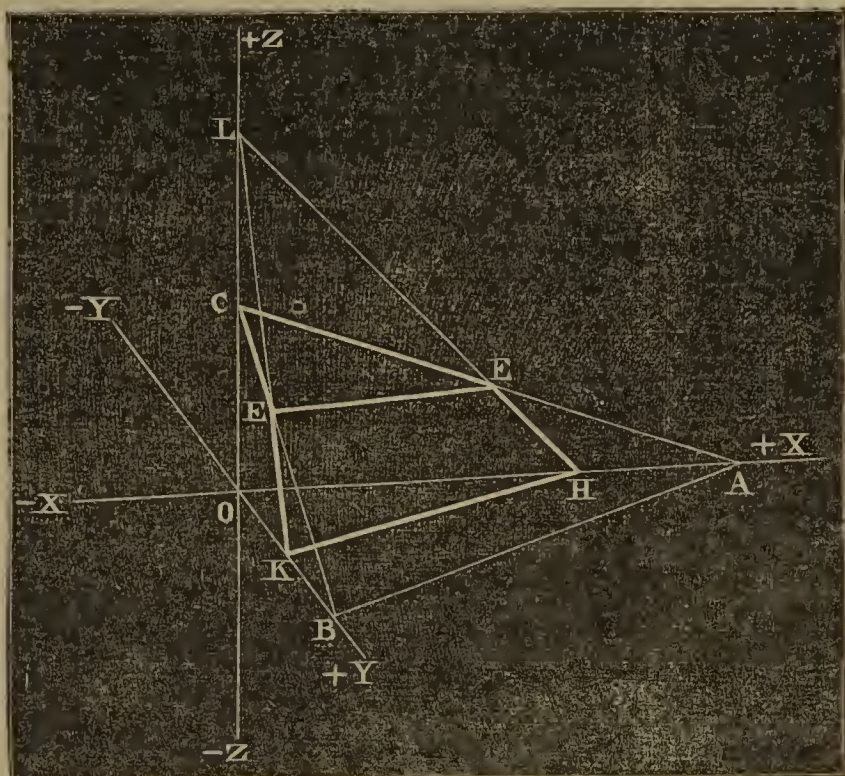
Coal in Patagonia.—G. De Saugainnecourt has discovered extensive deposits of coal on the coast of Patagonia, (lat. $53^{\circ} 9' 40''$ north (?); long. $73^{\circ} 13' 46''$ west). They extend apparently over 975 hectares and consist of three beds, the highest of which is five metres in thickness. The coal appears to belong to the class of lignites.

LECTURES ON THE MÖRPHOLOGY OF CRYSTALS AT THE CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

LECTURE II.

PASSING from the case of two axes lying in a plane Mr. Maskelyne proceeded to consider that of three axes in space. They were taken as before to be perpendicular to each other, the point *O* or *origin* in which they intersected being taken somewhere in the interior of the crystal. The three axes were supposed parallel to three edges in which three faces of the crystal would intersect. A position to the right of *O* parallel to the axis of *X*, or above *O* parallel to the axis of *Z*, or forward from *O* parallel to the axis of *Y*, was in each case considered as positive. Positions on the opposite sides of these to *O* were considered as negative. *A B C* and *H K L* were now supposed to be two faces of the crystal, and they were both supposed to lie in that octant which was included by the three positive directions of the axes. The edge in which they would intersect



would be the line *EE*. The portions of the axes intercepted by the plane *ABC* (the intercepts of this plane) are *OA*, *OB*, *OC*; those of the plane *HKL* are *OH*, *OK*, *OL*.

They will be larger in a larger crystal, smaller in a minuter one, *i.e.* according to the distance of the face from the centre; but their *ratios* will always be the same. Let these ratios be

$$OA : OB : OC = a : b : c$$

and $OH : OK : OL = \frac{1}{h}a : \frac{1}{k}b : \frac{1}{l}c$

Whatever fractions may actually represent the ratios of *OH* to *OA*, *OK* to *OB*, and *OL* to *OC*, we of course can always reduce these to such fractions of *a*, *b*, and *c* as have unity for their numerator.

The fundamental law of crystallography declares the ratio of these magnitudes *OH* : *OK* : *OL* to be always capable of being represented by such fractional ratios

$$\frac{1}{h}a : \frac{1}{k}b : \frac{1}{l}c$$

as present *h*, *k*, and *l* in the form of simple whole numbers, generally less than 7.

The magnitudes *abc* are called the *parameters* of the crystal; *hkl* are the *indices* of the face to which they refer. In the figure the face *HKL* meets

the axis X with an intercept $OH = \frac{2}{3}a$

the axis Y „ „ $OK = \frac{1}{2}b$

the axis Z „ „ $OL = 2c$

and $\frac{2}{3}a : \frac{1}{2}b : 2c = \frac{a}{3} : \frac{b}{4} : \frac{c}{1}$.

If the face H K L be denoted by the symbol $(h k l)$, in the case in the figure this symbol becomes (341) , the order of the indices always being taken in that fixed for the axes to which they refer, namely, in the order X Y Z.

It is evident, then, that on any crystal when once the axial system is determined on, i.e., when the axes and the face fixing the parameters have been chosen, all that is needed to determine a face is to know its indices.

The indices of the parametral face A B C are evidently (111) . Where a face is parallel to an axis, its index is for that axis zero. (340) is the symbol of a plane which inter-

cepts $\frac{a}{3} \frac{b}{4} \frac{c}{0}$; where $\frac{c}{0}$ represents an indefinitely great magnitude, so that the face H K L would not cut the axis Z as in the figure in a point L, but at an infinite distance, i.e., is parallel to O Z.

Had either of the points H, K, or L lain on the other side of the centre O to that on which it is in the figure, it would be indicated by a minus sign, and such a sign is placed over the corresponding index. Thus $(\bar{3}41)$ would be the symbol of a face for which the H and L points would lie to the left of O on O X and below O on O Z; K remaining as in the figure.

The faces whose edges are parallel to the selected crystallographic axes will have for their symbols (100) or $(\bar{1}00)$ for a face parallel to a plane Y Z containing the axes Y and Z; (010) or $(0\bar{1}0)$ for that of the plane Z X, and (001) or $(00\bar{1})$ for that of the plane X Y.

The ratios $\frac{1}{h} : \frac{1}{k} : \frac{1}{l}$ might equally easily and with equal truth be thrown into the form of whole numbers; the plane H K L in the figure having then the intercepts $4a : 3b : 12c$. The symbols obtained by using the fractional indices are, however, more simple, and admit in their use of more elegant mathematical expressions and methods of calculation.

The meaning of the term coordinates in connection with the three axes was now explained by the lecturer, who further stated that the planes designated by the symbols $(h k l)$ and $(p q r)$ may be represented severally by the expressions—

$$h \frac{x}{a} + k \frac{y}{b} + l \frac{z}{c} = 0$$

$$p \frac{x}{a} + q \frac{y}{b} + r \frac{z}{c} = 0$$

which are, in fact, expressive of the relations between the parameters $a b c$, the magnitudes $h k l$ (or $p q r$), involving the ratios of the indices, and the coordinates $x y z$ for any point in the plane; the planes being supposed to be moved parallel to themselves till they passed through the origin, in which case, obviously, their edge must pass through that point. This edge, then, in which these planes intersect would be a line, for each point in which the above two expressions have the same meaning, so that, by first getting rid of x by elimination from the two equations, we get the relation between y and z , the expression becoming—

$$(h q - k p) \frac{y}{b} = (l p - h r) \frac{z}{c};$$

and, secondly, by eliminating y , the relation between x and z is seen to be—

$$(h q - k p) \frac{x}{a} = (l q - k r) \frac{z}{c};$$

so that—

$$\frac{z}{c} \cdot \frac{1}{h q - k p} = \frac{y}{b} \cdot \frac{1}{l p - h r} = \frac{x}{a} \cdot \frac{1}{l q - k r},$$

which may be written—

$$\frac{x}{u a} = \frac{y}{v b} = \frac{z}{w c}$$

where—

$$w = l q - k r, v = l p - h r, u = h q - k p.$$

In the example previously considered, namely, in the two planes (111) and (341) , the expression becomes—

$$-\frac{x}{3a} = \frac{y}{2b} = \frac{z}{c},$$

so that the u, v , and w become in this case $[-321]$.

It was shown by a representation of three perpendicular axes, and of the co-ordinates strained in coloured threads upon it, that the edge in this case represented by its direction the diagonal of a parallelepiped, the sides of which were in the proportionate lengths of $-3a$ on the axis of X, $2b$ on the axis of Y, and c on the axis of Z.

On a crystal for every edge formed by a pair of planes there must be an indefinite number of other edges parallel to the edge in question, and it is clear that a plane perpendicular to one of these edges would be perpendicular to them all, and would be perpendicular to the planes to the intersections of which they are due. Such a series of planes forms a zone, and if those planes be each moved parallel to itself till it passes through the origin, all the planes of the zone would intersect in a single line, like the consecutive pages of an open book; that line is called the zone axis, and the plane perpendicular to it is called the zone plane. The expressions $[uvw]$ or, as in the example taken $[321]$ is placed within square braces to indicate that it represents a zone axis, and therefore also a zone. Evidently this zone axis would be identically represented by the edge in which any two planes of the zone would intersect; but it will be found that the actual numerical values thus obtained for the indices in the symbols of one edge in the zone differ in general by a common factor from those in the symbol of a different edge in it.

A ready method of obtaining the symbol of a zone from those of any two of its faces was then illustrated.

The latter symbols being written, each are repeated in two lines, and the indices of the new symbol being obtained by finding the difference of the products taken diagonally—first, of the second and third indices on the two lines; next, of the third and fourth; and, finally, of the fourth and fifth indices on each line.

The next relation illustrated was that connecting the indices of any other plane in the zone with those of the two taken to give the symbol of the zone, —viz.

$$e u + f v + g w = 0,$$

where $u v w$ are the indices of the zone $[h k l, p q r]$ as obtained by the above method from the symbols for the faces $(h k l)$ $(p q r)$.

A similar expression to that for a zone as derived from two of its planes may be got for a face common to two zones.

$$\text{Thus, } e u + f v + g w = 0,$$

$$\text{and } e u' + f v' + g w' = 0,$$

represent the relation of the face $e f g$ to the symbols of each of two zones $[u v w]$ and $[u' v' w']$, i.e., $h k l p q r$ and $h' k' l' p' q' r'$.

$$\text{Then, } e = v w' = w v'$$

$$f = w u' - u w'$$

$$g = u v' - v u'.$$

It is clear that these values for $e f g$ must be rational, so that any two zones must be tautohedral in a plane satisfying the condition of rationality which is the condition

necessary for such a plane being a possible face of the crystal. Examples of these laws were given in the case of the zone [111, 341] or [321], which also contains the faces (214) and (012), the edges for which gave symbols differing from each other by common factors, such as -1, 3, and 5.

So also this zone [321], and a zone [110, 001], i.e., [110], have in common the face (111) and the face (111).

ANALYSIS OF MOFFAT AND HERTFELL SPAS COLLECTED ON THE 5TH AND 12TH OCTOBER, 1874.

By W. JOHNSTONE, Edinburgh.

Moffat Spa.

THIS valuable sulphurous spring, to which Moffat owes its celebrity, was discovered in 1633, and the discoverer is said to have been a daughter of Bishop Whiteford. There are two springs, the upper and the lower, but being only about a yard or so distant, they are regarded as the same well. The springs rush from a cavity of a rock on the brink of a linn, down which rushes a mountain stream. The spring is enclosed by a small square winstone building, the water being collected in a hollow hewn out in the rock, from which it is drawn off by means of a pipe, and handed to the drinkers, containing the following constituents—

Specific gravity at 60° F. 1001·068
Temperature 49·5° F.
Temperature of air 64·0° F.

Sodium chloride	0·8524
Sodium sulphhydrate	0·0078
Calcium chloride	0·1243
Calcium sulphate	0·0125
Calcium carbonate	0·0940
Magnesium chloride	0·0581
Magnesium carbonate	0·0402
Potassic chloride	0·0616
Ferrous carbonate	0·0247
Silica	0·0180

1·3936

Total residue in one litre dried at 356° F.	1·3874
Volatile and organic matter	0·1150

Total solid residue in one litre 1·5024

Iodine, manganese, and lithia, in minute traces.

Gases dissolved in one litre	34·508 c.c.
Hydrogen sulphide	5·325
Nitrogen	25·644
Carbonic dioxide	2·539
Oxygen	0·999

34·507

Hertfell Spa.

This also valuable aluminous sulphate chalybeate, springs from the bottom of a deep rocky ravine on the side of the mountain of the same name.

It is distant five miles from Moffat, and there being no regular road part of the way, the generality of the drinkers of it have to obtain their supply from Mr. T. Hetherington, druggist, in the town.

Hertfell Spa, which has a strong astringent taste, is most powerful after a fall of rain, and in the greatest perfection when wet is preceded by continued dry weather. It may be preserved for a lengthened period (without the ceremony of hermetical sealing) in a state of purity and efficiency. The spa was discovered by an eccentric individual, named John Williamson, in 1748, and is 1155 feet

above the level of the sea, or 808 feet above the level of Moffat High Street.

Specific gravity 1000·386
Temperature 49° F.
Temperature of air 56° F.

Ferrous sulphate	0·2109
Aluminic sulphate	0·1970
Sodium chloride	0·0050
Sodium sulphate	0·0048
Calcium sulphate	0·0352
Calcium carbonate	0·0280
Magnesium sulphate	0·0233
Magnesium carbonate	0·0121
Ferrous carbonate	0·0240
Silica	0·0050

0·5453

Total residue in one litre dried at 356° F.	0·5321
Volatile and organic matter	0·0022

Total residue in one litre .. 0·5343

Contains traces of manganese and potash.

Gaseous constituents in one litre .. 30·854 c.c.

Carbonic dioxide	6·734
Oxygen	6·062
Nitrogen	18·057

30·853

ON THE DISTILLATION OF AMMONIA IN PRESENCE OF SULPHOCYANIDES.

By A. ESILMAN.

THE estimation of ammonia by distilling with caustic alkali a known weight of any ammoniacal salt into standard dilute sulphuric acid, and determination of the acid thus neutralised, is one of those processes which are exact enough to satisfy the requirements of the scientific chemist, and capable of such rapidity of execution as to make them invaluable in the hands of the manufacturing chemist. With carefully standardised test acid and alkali solutions the results need not vary more than one or two-tenths per cent. Having had occasion within the last two years to use this volumetric method daily in the examination of gas liquors, and sulphates of ammonia made from the washings of gas oxide of iron, my attention has several times been drawn to some little discrepancies cropping up in spite of the greatest care. In investigating the causes of these differences, the question arose,—does the sulphocyanide present in the sulphate of ammonia as well as in the gas liquor decompose during the distillation under the influence of the excess of alkali? Sulphocyanides submitted to dry distillation with slaked alkalies produce large quantities of ammonia, and it was possible that a similar reaction might take place, though more slowly, at the boiling temperature. To test this point a solution of sulphate of ammonia containing four to five per cent of sulphocyanide was made and used for the following experiments, in which definite quantities were boiled for various lengths of time with different proportions in excess of the liberating alkali.

The following results were obtained:—

Using—	Per cent of Ammonia.
Caustic soda	23·87
„	24·19
Carbonate of soda	24·15
„	23·64
Lime	23·47
„	23·80
„	23·608
„	23·97

These results were sufficiently contradictory to confirm my suspicions, and also to raise the doubt that only after the complete removal of the sulphocyanogen could the ammonia be distilled and correctly determined. Before attempting to settle this point I resolved to make sure that there was no defect in the distilling apparatus. This consisted of a twenty-ounce flask, generally filled half full, connected by glass and india-rubber tubing with two bottles, and so arranged that none of the boiling liquid in the flask would be sucked over during sudden condensation. Pure water coloured with delicate pink litmus solution was put into the bottles, and ammonia-free dilute caustic soda solution into the flask; the latter was then boiled into the former. After a few minutes ebullition there was a gradual change in the coloured liquid. It became purple, then blue, and there was thus seen to be manifestly something at fault. The small flask was replaced by a large one, into which the distilling liquid was poured, occupying about half an inch at the bottom; but on *slow* boiling the same result was obtained, and not only once, but a dozen times. The interposition of a bulbed tube containing broken glass between the flask and bottles made no difference, thus showing that the alkali could not have been carried over mechanically. The same results were also obtained when milk of lime was employed in place of caustic soda, and yet neither of these alkalies could be found in the distillate. The anomaly, however, was soon explained:—On substituting bent glass tubing in place of the glass and india-rubber found so convenient, and continuing the distillation, no alteration in the colour of the pink litmus solution was observed, even after long boiling, and a portion of the distillate subjected to Nessler's test gave no indications of ammonia. When the india-rubber tubing was used once more, the distillate gave a very decided colour to Nessler's solution.

Although I have not seen any published records of the absorbent powers of india-rubber tubing for ammonia, I can scarcely believe that it has so long escaped notice; and, considering its wide application, it may not be amiss in me to impress upon others the necessity of restricting its use to the utmost point consistent with flexibility in connecting apparatus. It is quite possible that the materials incorporated with the rubber during the manufacture, as gypsum for example, may be the cause of the disturbance; but this point I have not examined.

Having then altered my connecting tubes so as to employ a minimum of india-rubber, I made the following experiments to ascertain the extent of the decomposition of the sulphocyanogen during distillation with various alkalies. A solution of sulphate of ammonia containing 4 per cent of sulphocyanogen was used. The results are as follows:—

Liberating Alkali.	Per cent of Ammonia.
Caustic soda	21.261
"	21.672
"	21.354
Caustic lime	20.883
"	20.990
Caustic magnesia	20.998
"	20.873
After separation of the sulphocyanogen as sulphocyanide of copper, and distil- lation with caustic soda	20.908

Another sample of sulphate of ammonia of similar composition gave—

By distillation with soda	22.08 per cent
" .. magnesia	21.33

These results are sufficiently conclusive to show that decomposition of sulphocyanogen does take place when caustic soda is employed in liberating the ammonia; that the extent of error thus introduced is very appreciable; and that it can be eliminated by using caustic lime or magnesia in place of soda. I prefer lime, as magnesia, from its great insolubility, is slow in its action.

Manchester, December 24, 1874.

NOTES ON THE FORMATION AND CONSTITUTION OF TORBANITE.

By WILLIAM SKEY.

IN prosecuting experiments previously detailed, upon the evolution of heat caused by mixing dry clay with various liquids, I noticed such an increase of temperature in the case of petroleum that I suspected an absorption of a portion of the matters dissolved in this liquid had occurred, and so was led to investigate the matter further, when the following results were obtained:—

- (1.) That our commercial kerosenes are nearly or quite decolorised by mixing them with dry clay, and our best native petroleum greatly modified.
- (2.) That this process is very much quicker when the clay used has been dried at 100° or so C.
- (3.) That in such a case the clay, if white, acquires a rose and afterwards a black colour, while its streak is light brown.
- (4.) That torbanite has the same effect as clay.
- (5.) That the coals I have examined, whether hydrous or anhydrous, do not appear to exercise any absorbent action upon the petroleum oils.
- (6.) That the same is true of diatomaceous earth (dry), carbonate of lime, and gypsum, hydrous or anhydrous, also pumice-stone and pipe-clay (ignited).
- (7.) That kerosene which has been completely decolorised by clay, when heated to 100° to 150° C. blackens clay, but has no such effect upon other porous substances, as gypsum, prepared silica, or the light oils of kerosene.
- (8.) That clay is similarly affected by hot paraffin.
- (9.) That clay can readily be charged with some of the constituents of petroleum, to such an extent as to have almost the consistence as well as the appearance of torbanite.

These results have, I believe, an important bearing upon our present theories as to the formation and constitution of the valuable mineral torbanite. As to the formation of this mineral, it plainly appears from them that clay strata will abstract the colouring matter of petroleum passing through them.

If this process is carried on to a small extent we have only a feebly bituminous clay, but if carried on till the clay is saturated, or nearly so, we have a mineral which I believe has exactly the constitution of torbanite.

During the formation of this mineral the petroleum passing through it would be purified to a greater or lesser extent.

From what has been already stated, I feel sure the absorption is not of a mechanical but of a chemical nature, and this brings me to the next point, that is, the true constitution of the mineral in question, torbanite or bog-head coal.

As to its constitution, this mineral is associated with the amber group in our best mineralogical works, and the earthy matter is thrown out of the formula. Now this is within small limits uniform in amount in the case of all the samples of this mineral yet analysed, being from 19 to 26 per cent, and it is essentially silicate of alumina that is anhydrous clay.

I consider, therefore, the ash of this mineral is not an accidental element as it is now considered, but that it is an essential part of it,—that in fact torbanite is a combination of a bituminous kind of substance with clay, the water of the clay being either substituted by it or a bituminous-silicate of alumina formed, which substance may have no affinity or but a very slight one for water.

I should state that the coloring matters of petroleum and kerosene are in general terms described as of a bituminous nature—but whether bitumen itself is actually or universally present has not yet been demonstrated. However, these colouring matters are certainly oxidised hydrocarbons, and so class with bitumen and the combustible part of torbanite.

Being thus oxidised hydrocarbons they can hardly fail to be of an acidic nature, and so the statement as to their capability to chemically combine with clays as shown, is one which a consideration of the basic nature of clay will, I think, greatly predispose us to admit to be a correct one.

In conclusion, these results tend to indicate—

- (1.) A cheap and expeditious method for purifying our coloured kerosenes, one in which there need hardly be any waste.
- (2.) That by using pure clay useful pigments may perhaps be obtained in this manner.
- (3.) That torbanite is *not coal* but a chemical combination of an acid hydrocarbon with silicate of alumina. In this assumption I accept for the present the popular opinion which maintains the ash of coal itself to be an *accidental* element.
- (4.) That our present formula for torbanite requires amendment so as to include earthy matters.

I will only add that judging from the basic nature of alumina and the refusal of silica in any form to combine to a notable extent with any of the constituents of petroleum, it appears most likely it is the alumina of the earthy matters of torbanite to which the retention of its combustible part is due. This matter and the possibility or otherwise of substituting compounds of tin, iron, copper, &c., for that of alumina as absorbents of the substances named, is now engaging my attention, and so I trust to be able to give information upon these points at an early date.

THE PRIESTLEY CELEBRATION AT NORTHUMBERLAND, PENNSYLVANIA.*

THE year just closed has witnessed a celebration unique in history. Two nations have simultaneously done honour to the memory of an illustrious chemist who, a century ago, discovered oxygen and thus opened a new era in science. In England, in the very town where his house had been sacked and burned, his books and manuscripts scattered to the winds, his apparatus destroyed and his very life jeopardised, a statue has been erected to his honoured memory and inaugurated amidst public applause. In America, where he found a refuge,—not quite unassailed—the chemists of the great republic have met at his grave as the most suitable spot for a retrospect of the progress of chemistry. Their celebration was unclouded with any painful and humiliating memories. They could pay their tribute to the great departed with free spirits. Not so we on this side the Atlantic. Our festive ceremonial was at the same time an act of national penitence. We remember with shame the folly and the brutality of our forefathers. We blush for the statesmen, the magistrates, the clergy, the publicists who instigated this outrage and applauded its perpetrators. We ask ourselves, too how far we are really removed from scenes like the great Birmingham riot. No writer, lecturer, or thinker is now, indeed, in peril of having his house pulled down. But do not recent—very recent—events warn us that our vaunted toleration of unpopular opinions is merely

“The inquisition rebaptised,
The old brute torture spiritualised.”

As a proof of the hatred which has followed the memory of Priestley, even into the second half of the present century, we may mention that, in 1851, a chemist—whose name is immaterial—delivered at a Mechanics' Institute near Manchester a lecture on the life and discoveries of Priestley. For this he was threatened with the loss of an appointment which he at that time held, and was subjected to every practicable mode of persecution and annoyance. This was the more gratuitous, since in the lecture he confined himself strictly to a review of Priestley's chemical and physical

researches, and entirely abstained from discussing his theological and metaphysical labours. If, then, we as a nation have learnt to take a calmer and a higher view of Joseph Priestley, and if we feel, as we ought, sincerely ashamed of our conduct towards him, it must be owned that our progress since the year of the Great Exhibition has been rapid indeed. In the last century, the President of the Royal Society was asked to procure a refutation or condemnation of some of the electrical discoveries of Benjamin Franklin, on account of the republican and rebellious character of the American philosopher. In this century a man has been forbidden to lecture on the discovery of oxygen, because its discoverer was a unitarian in religion! It is hard to say which demand was the more absurd and the more tyrannical.

From a scientific point of view the position of Priestley is most remarkable. At no period of his life did chemistry take up the whole or even the greater part of his time and attention. It may even be doubted whether he was thoroughly well acquainted with the science as then understood. Yet in spite of these drawbacks he was able to make the most remarkable and fruitful discoveries. There is perhaps no second instance of a man achieving such great things for science amidst so many distracting pursuits. Some persons have regretted the multifarious character of his studies, and have maintained that he might and would have accomplished far greater things had he confined himself to one subject. We do not share this view. Priestley acted in accordance with his own faculties, character, and early training, and the result is patent to the world. Had he flourished at an earlier date chemistry would probably have never attracted his attention. If now living he would probably never have been able to attain the nicety of modern experimental research, and would not have taken time to master the intricacies of modern theories. Coming upon the stage when he did he was able to render the most important services to science and to the world and to win for himself an undying reputation. It is singular that so ardent a reformer in politics and theology should, in chemical theory, prove so decided a conservative. Curious, too, that he should to the last defend the phlogiston theory which his own discoveries had undermined.

All honour, however, to the martyr of Birmingham, and may his memory ever prove a band of brotherhood between the men of science in the land of his birth and in that of his death.

THE VERTICAL LANTERN.

AT the late Industrial Exhibition of the Franklin Institute in Philadelphia, as also at the like Exhibition of the American Institute in New York, silver medals were awarded for the apparatus shown in the accompanying figure, which is manufactured by Messrs. George Wale and Co., instrument makers to the Stevens Institute of Technology, Hoboken, N.J.

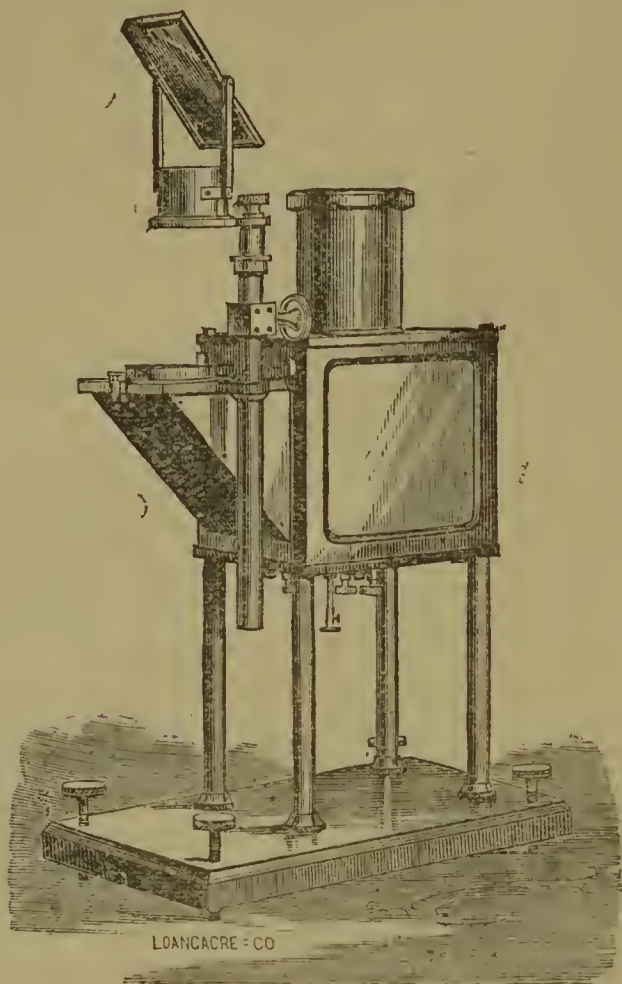
In its present remarkably efficient state of development this apparatus owes much to one of our frequent contributors, Professor Morton, as well as to the mechanical ingenuity of Mr. Wale, and has gone into very general use in the principal colleges of the United States.

The cut (taken from a photograph) shows the apparatus as adjusted to exhibit on the screen such objects as waves in water, cohesion figures, and the like.

The light from the lime cylinder or electric arc passes through two large lenses, by which it is thrown in a parallel beam on an inclined mirror in the triangular box in front. By this it is reflected upwards, and is condensed by a large lens standing horizontally on top of the same triangular box, so as to pass into the objective above, and is then by the small upper mirror thrown on a screen. This upper mirror, with the objective, is carried by a bar provided with rackwork, by which an accurate adjustment for focus can be made.

* From the *American Chemist*, Nos. 50 and 51, 1874.

The objects rest directly on the plate holding the large horizontal condenser. When the apparatus is to be used for ordinary objects which can be held in a vertical position, a little screw in the front of the horizontal plate is



taken out, and then the triangular box carrying the lower mirror is removed, allowing the horizontal plate to swing down into a vertical position, carrying with it the rack-work bar and objective into their proper positions.

NOTICES OF BOOKS.

Address Delivered before the British Association, assembled at Belfast, with Additions. By JOHN TYNDALL, F.R.S., President. Seventh Thousand. London: Longmans, Green, and Co.

THE interest excited by this Address when first delivered in September last, seems far from diminishing. It certainly lays before the public no novel facts, the fruit of recent research; no profound and startling generalisations, heretofore strange to the general public. There is nothing which was not fully known to men of science, and not only so, but to all persons of respectable culture. Nor is any new mode of philosophising recommended for the first time. As the author reminds us in his preface, he has, in former essays and papers, claimed for Science the right of passing the bounds of experience, and this claim has provoked no general outcry. Yet now any one not alive to the progress of discovery for the last quarter of a century, and to the views prevalent among the most advanced thinkers, might be led to suppose that some great and alarming revelation had been for the first time announced. The sermons, lectures, resolutions, memorials, letters, and leaders which have appeared on the subject would form, in themselves, almost a library. On the other hand, Prof. Tyndall has published his Address first with one preface, explanatory and controversial, and subsequently with a second. In these prefaces we are bound to declare that there is no appearance of, and no attempt at, recantation. What he said at Belfast the author is willing to abide by. He explains, but he does not seek away. Only, and with fullest right, he objects to being held responsible for words which he never ut-

tered. Of that sophism which consists in imputing to an opponent views he has never expressed the anti-Tyndallian writings furnish typical specimens. We might assume that any one claiming the position of a scholar and a gentleman would, before uttering a severe and sweeping condemnation of an Address like that before us, at least have taken the trouble to read it, and any available documents bearing upon it. To neglect such easy means of arriving at the truth is more than irrational,—it is profoundly immoral. We quote an instance from the author's earlier preface:—"An evening paper of the first rank, after the ascription of various more or less questionable aims and motives, proceeds to the imputation that I permitted the cheers of my audience to 'stimulate' me to the utterance of words which no right-minded man, without a sense of the gravest responsibility, could employ. I trust the author of this charge will allow me, in all courtesy, to assure him that the words ascribed by him to the spur of the moment were written in Switzerland; that they stood in the printed copy of the Address from which I read; that they evoked no 'cheers,' but a silence far more impressive than cheers."

To take another instance:—"In the *Times* of Nov. 9th he (the Bishop of Manchester) is reported to have expressed himself thus: 'In his lecture in Manchester Prof. Tyndall as much as said that at Belfast he was not in his best moments.' Now, considering that a *verbatim* report of the lecture was at hand in the *Manchester Examiner*, and that my own corrected edition of it was to be had for a penny, the Bishop, I submit, might have afforded to repeat what I actually said, instead of what I 'as much as said.' I am sorry to add that his rendering of my words is a vain imagination of his own. In my lecture at Manchester there was no reference, expressed or implied, to my moods in Belfast." Such cases as these need, surely, no comment.

But, ably as Prof. Tyndall deals with those of his assailants whom he selects from the throng, it is questionable whether these prefaces are not a mistake. If he has advanced too confidently the hypotheses as yet doubtful,—if he has strayed too far from the clear daylight of the inductive philosophy into a visionary twilight,—he must be judged by his peers, by men of science, not by ecclesiastics. To the Cullens and the Magees, the Frazers and the Capels, his plea ought to be "*non coram iudice*."

We cannot here pass over the claim advanced by Monsignor Capel as to the right of his Church, or any Church, to determine what true Science is. Such claims have not even the shadow of validity. We should as readily accept the decision of the Committee of the Stock Exchange, or of the Guardians of St. Pancras! Only men of science, acting as such, have either the right or the power to pronounce what true Science is. The mere attempt on the part of others, be they prelates or ploughboys, is intrusive charlatanism.

Into an examination of the views put forward by Prof. Tyndall we can the less enter as the Address touches not at all upon Chemistry, and scarcely upon Physics. Its main sphere is the science of life. The main questions which it raises relate to the passage from the inorganic to the organic, to the origin of sensibility and consciousness. These are subjects which have hitherto defied explanation, and have been set apart as inscrutable mysteries before which man must be content to pause and wonder. There are minds who enjoy such a position, and who positively applaud when Science is obliged to confess her limitations. But the true philosopher will never exchange Bacon's inspiring watch-word "*Plus ultra!*" for an anile "Rest and be thankful." As in inorganic science, we shall from failure learn the secret of success. A Roman senate went out to salute Varra, the defeated of Cannæ, because he had not despaired of his country. Can we pay any smaller tribute to the minds who are now grappling with the most difficult problems that have ever confronted human intelligence? They may be mistaken, more or less gravely, but they are, at least, working. Is it seemly that their

attention should be distracted by the discordant cries of those who, in former ages, reviled—in the same manner—Copernicus, Kepler, Galileo, and Newton?

The Induction of Sleep and Insensibility to Pain by the Self-Administration of Anæsthetics. J. M. CROMBIE, M.A., M.D. London: J. and A. Churchill,

THE object of this pamphlet is to describe an apparatus by means of which patients requiring relief from pain may conveniently administer anæsthetics to themselves. The author points out that in self-administration there is little or no fear of an over-dose, since "the inhalation of the vapour ceases whenever the patient begins to sleep, and this because it is dependent on certain movements of the hand, which are arrested by the approach of sleep." Whilst fully admitting the value of this idea, we cannot refrain from asking whether there is not a certain element of danger in facilitating the self-administration of anæsthetics? An old medical friend of ours contends that the growing love for narcotics, anæsthetics, and in short for whatever is "soothing," is a most serious symptom of physical degeneracy in the human race, and that these drugs, in the long run, augment the very evils which they temporarily relieve.

Report of the Sanitary Committee of the Board of Health on the Concentration and Regulation of the Business of Slaughtering Animals in the City of New York. New York: D. Appleton and Co.

IT is small consolation to us in London to learn that New York is suffering from the same sanitary—or rather unsanitary—evils as ourselves. On both sides of the Atlantic Science has pleaded long and earnestly against intramural graveyards, slaughter-houses, cesspools, sewers ventilated into streets and dwellings, &c. It now only remains for fever, cholera, and dysentery, to speak in tones which even the deafest and most vested-interest-ridden public cannot fail to hear. The only misfortune is that the innocent must suffer with the guilty, and the scorned and neglected prophet perish with those whose purblind selfishness opposed his teachings.

The New York Board of Health propose to abolish all slaughtering of cattle within the city, and to establish *abattoirs* in suitable places. We wish them success in so necessary an undertaking.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 23, December 7, 1874.

Results produced by the Joint Action of a Battery and of Electro-capillary Currents.—M. Becquerel.—The author has investigated the possibility of augmenting or decreasing the intensity of electro-capillary action by the aid of the current of a battery of several elements. Among the bodies experimented upon was the chloride of chrome, which yielded an intense black deposit. This was found to be a hydrated sesquioxide of chrome; the black colour is due to some peculiar molecular arrangement, and the crystallisation belongs to the regular system. Perchloride of iron yielded also a black, crystalline deposit consisting of hydrated sesquisulphide. Chloride of bismuth also deposited the sulphide of the metal. Acetate of lead deposited metallic lead in a very brilliant state. Nitrate of copper yielded a brilliant deposit of metallic copper on the negative surface and crystalline sulphide of

copper on the other. With the chlorides of gold and of zinc no decomposition was produced. The apparatus consisted of a split tube containing the solution to be experimented upon, and plunged in a larger tube containing a solution of an alkaline sulphide. The action was augmented by means of two slips of platinum in connection with a battery, the positive being immersed in the metallic solution and the negative in the sulphide.

Intervention of Physico-Chemical Forces in Vital Phenomena.—M. Becquerel.—The author thinks that the electro-capillary forces play the greatest part in organic beings. These forces requires for their production merely permeable tissues separating two liquids of different natures, and find, consequently, in the organism the conditions necessary for their origin. Their existence, direction, and intensity are easily proved. The author found arterial blood negative with venous blood, instead of being positive as M. Scoutetten announced.

On Magnetism.—M. J. M. Gauguain.—A continuation from *Comptes Rendus* Jan. 13th, June 30th, Sept. 8th and 29th, Nov. 10th, and Dec. 2nd, 1873; and March 22nd, June 1st and 15th, Sept. 7th, and Oct. 5th, 1874. It is not adapted for abstraction.

Ureides of Pyvuric Acid, Synthesis of a Homologue of Allantoin.—M. E. Grimaux.—(See *Comptes Rendus*, 1874, vol. lxxix., p. 526.) Uric acid and its congeners, sarcosine and xanthine, appear to be derived from the residues of aldehydic or acetonetic acids. The author has studied the action of urea on an acetonetic acid, the pyvuric, in order to obtain bodies of a constitution analogous to those of the uric series. In a former communication he has shown that this reaction is very complex and gives rise to divers bodies according to the relative proportions of acid and of urea. In the present memoir he describes the derivative obtained when an excess of urea is allowed to act upon pyvuric acid. To prepare it, two parts of urea, finely powdered, are moistened with one part of the acid boiling at 160° to 170°, and the mixture is kept for some hours at 100°. The mass becomes liquid, gives off pure carbonic acid, then it grows turbid, and is filled with a solid matter. When the reaction is over the whole is taken up in an excess of boiling alcohol, filtered, and the residue dissolved in ten times its weight of boiling water. The filtrate, on cooling, deposits white brilliant crystals, of the composition $C_5H_8N_4O_3$. This body, pyvurite, is insoluble in alcohol and ether, sparingly soluble in boiling water, but soluble in ten times its weight of boiling water. It dissolves in ammonia, but without forming with it a combination. If dried in the air it does not lose water below 145°. At 155° it begins to lose weight and is converted into a new substance, insoluble in boiling water but soluble in alkalis, whence it is re-precipitated by all acids, even the carbonic. If more strongly heated, pyvurite is destroyed without melting, giving off cyanic and ammoniacal vapours, and leaving a residue of charcoal. If boiled with baryta water it yields urea, of which a part is converted into carbonate of ammonia, oxalate, and a small quantity of a soluble salt of baryta. Pyvurite does not precipitate metallic salts, except with nitrate of mercury, with which it forms a copious white precipitate. A mixture of aqueous solution of pyvurite and of nitrate of silver gives a bulky white precipitate on the addition of potash.

Observations on the Species of the Genus *Phylloxera*.—M. Signoret.

Method followed for the Discovery of the Substance most Efficacious against the *Phylloxera*, at the Viti-cultural Station at Cognac.—Max Corny.

Solutions of Chrome Alum.—M. D. Gernez.—It is generally admitted that solutions of chrome alum which have been rendered green by heat return spontaneously and gradually to the violet modification, and deposit the alum in the shape of regular octahedra. On the other hand, the crystals have been known to remain green for months without depositing alum. If we make a hot con-

concentrated solution of chrome alum in vessels which are sealed at the lamp while boiling we observe that, however concentrated the solution, it does not, at common temperatures, deposit crystals of violet alum. Moreover, contrary to the assertions of M. Lecoq de Boisbaudran, it does not take the tint of solutions made in the cold, even after a very long time. These green solutions, preserved from contact with a crystal of alum and submitted to slow evaporation, whether by heat or in the dry vacuum of the air-pump, give as residue a solid, transparent matter, of an emerald green. This residue is the same, whatever may be the state of dilution of the original solution, and it preserves the same colour and appearance for more than a year. If instead of evaporation it is exposed to intense cold, crystals of alum are not produced. But a solution produced at the same temperature and not modified by heat yields when exposed to cold violet octahedral crystals of alum. If the vessels containing the green saturated solution are opened and the liquid touched with a crystal of chrome alum, a violet crystallisation begins and gradually increases. This effect may be produced by the contact, not merely of chrome-alum, but of any alum whatsoever. Those of potash, ammonia, iron, and thallium produce violet crystals, like chrome alum itself, contrary to the assertion of M. Lecoq de Boisbaudran. But the contact of crystals other than alums is unable to induce the crystallisation of the supersaturated solution.

Transformation of Persulpho-cyanogen.—M. J. Ponomareff.—The author has studied the action of perchloride of phosphorus and of ammonia upon persulpho-cyanogen.

Transmission and Inoculation of the Virus of Carbuncle, &c., by Flies.—M. J. P. Megnin.—The author finds it proved that certain blood-sucking flies with rigid and penetrating probosces, such as the *Glossina* (Tsetse flies), *Simulia*, &c., may effect the transmission of virulent maladies, and among others, of carbuncle.

Reimann's Farber Zeitung, No. 43, 1874.

This number contains remarks on the recent rise in the price of raw aniline and consequently of aniline colours; receipts for a cerise on woollen yarn; a marine blue on mixed woollen and cotton goods (both pieces and garments); and a fast black on cotton yarn.

There is the continuation of a paper on the removal of "burls" from wool by chemical means.

Böttger gives the following process for the manufacture of corallin. 1 part of crystalline oxalic acid, $1\frac{1}{2}$ parts of phenol, and 2 parts of oil of vitriol are heated for five to six hours to $140-150^{\circ}\text{C}$. The resulting mass is poured into hot water and boiled. There is thus obtained a resinoid product, brittle when cold, and with a green metallic surface reflection; when ground it yields an orange-red powder.

Daudenart and Verbert patent a process for utilising the waste water from scouring wool. It is mixed with a solution of caustic baryta as long as a precipitate is formed. When this has settled the clear liquid is drawn off, evaporated to dryness, and the residue ignited, yielding a mixture of potash with a little chloride of calcium. (In England soda would be generally found in place of potash). The fatty acids are separated from the precipitate by means of hydrochloric acid, washed, and pressed. The solution of chloride of barium is mixed with hydrate of magnesia, and carbonic acid is passed into the mixture until all the baryta is precipitated. Finally the carbonate of baryta is re-converted into caustic baryta by ignition with charcoal.

Prof. A. W. Hofmann has found phenylen-diamin ($\text{C}_{12}\text{H}_5\text{N}_2\text{H}_3$) in aniline oils boiling at high temperatures, i.e., between 270° and 300° . It is a solid, crystalline body, boiling at 280° . The crystals melt at 63° . It was formerly made directly from binitro-benzol. Its occurrence in the above mentioned aniline oils is explained by the circumstance that in nitroising artificial impure benzol

not merely nitro-benzol but also binitro-benzol is formed, which by subsequently taking up hydrogen becomes phenylen-diamin. If the substance can be obtained in quantity, it may possibly serve for the preparation of phenyl-brown (Manchester brown), which has been already used in dyeing with success.

No. 44, 1874.

This number contains receipts for a marine blue on woollen pieces, garments, or yarns; for a deep aniline blue on mixed woollen and cotton garments; and a yellowish mode on mixed stuffs and garments.

An adventurer is going about Germany selling receipts for a "new brilliant black" and a "cheap brown." The former is produced by boiling the goods with lead-ore and soda, and the latter with truffles (!) 20 to 30 lbs. of which suffice for 100 lbs. of cloth.

Then follows a receipt for a Guernsey blue on woollen yarn and for preparing *trame* silk.

No. 45, 1874.

The editor points out that soluble glass "free from amorphous silica" is being offered to dyers as a particularly valuable article.

There are receipts for a blond, a light olive, and a stone-grey on wool; a coffee-colour on woollen yarn; an aniline violet on wool and cotton rags; an olive and a reseda on wool and cotton garments; a peacock-blue on cotton yarn, and a white on silk.

For printing a Prussian blue Scheurer dissolves the colour in alkaline tartrate of ammonia. 50 parts tartaric acid, 190 ammonia, and 110 dry powdered Prussian blue, are dissolved together in 150 parts of water and thickened with an equal weight of tragacanth mucilage. The goods are printed with this mixture, dried, and passed through sours, which developes the colour. For dyeing the goods are steeped in the liquid—without thickening—dried and soured. The colour is very fast.

Moniteur Scientifique, du Dr. Quesneville,
November, 1874.

Formation of Molasses.—F. Anthon.—Chemists are not agreed on the origin of molasses. Some maintain that its formation is due to non-crystalline organic bodies, gums, extractive, &c. Others hold that it is produced by the presence of mineral salts in the saccharine juice. Lastly, a third party believe that the substances "other than sugar" may be classified as (a) generators of molasses; (b) indifferent; and (c) preventers of molasses. The author shows that chloride of calcium, added in small quantities, decreases the yield of molasses. But if added in large excess it prevents altogether the crystallisation of sugar, and the whole mass becomes molasses. Hence one and the same body may be either regarded as promotive or preventive of the formation of molasses, and the above classification must fall to the ground.

Preparation of Saffranin.—A. Ott.—The author recommends as the best method to treat with syrupy arsenic acid the azotised compounds obtained by acting with nitrous acid upon heavy aniline oils containing toluydin, and boiling at 198° to 200° . For the preparation of the nitrous acid, he takes 1 part of starch and 8 of nitric acid, heating in the water-bath; the gas generated before being conducted into the aniline oil is not washed in water, but passed through sulphuric acid. When the aniline has become a maroon-brown, and crystallises on a watch-glass, 100 parts are mixed with 90 parts of arsenic acid at 72 per cent. To prevent a too rapid rise of temperature the arsenic acid is introduced very gradually. The mass is then heated on the sand-bath till a violet colouration appears. According to Reimann (*Farber Zeitung*, No. 41, 1871) the application of heat for five minutes is sufficient. The author finds that in operating upon 50 grms. it is necessary to heat for at least two hours. The whole is

then boiled with water containing lime, in which the violet colouring matter is insoluble. To remove the deposit formed the whole is poured upon flannel filters, beneath which is a layer of sand. The filtrate is slightly saturated with hydrochloric acid, and an excess of chloride of sodium is added. The precipitated saffranin is purified by solution in acidulated water, and re-precipitation with salt.

Gazzetta Chimica Italiana, Anno iv., Fascicolo 6, 7, and 8, 1874.

Isomerism of Aromatic Bodies with Six Atoms of Carbon.—W. Koemer.—A paper occupying nearly 150 pages, and incapable of being usefully abstracted.

Action of Hydriodic Acid on Santonic Acid.—S. Cannizaro and D. Amato.—A preliminary notice.—The direct product of the action is a hydrocarbon of the composition $C_{15}H_{24}$.

On Meta-Santonin.—S. Cannizaro and D. Amato.—Meta-santonin has the melting-point 160.5° . It is not affected by the action of the air or of light; it forms prismatic crystals, and under a pressure equal to 10 m.m. of mercury it melts at 238° to 240° . It is tolerably soluble in hot, but sparingly soluble in cold water; very soluble in ether and alcohol; most soluble in an aqueous acid solution formed by the action of water upon the iodide of phosphorus. Solution of potassa does not seem to have any effect upon it.

Quantitative Determination of the Atomic Group C_2H_3O contained in Acetyl Substitution-Products.—Fausto Sestini.—A known quantity of the acetylic derivative is placed in a suitably-arranged recipient with a measured volume of normal solution of caustic soda, and is heated to 100° for some hours. Into the cold liquid is poured a volume of normal solution of sulphuric acid exactly equal to that of the alkaline solution employed. It is then filtered, the vessel and filter are well washed, and with the standard solution of soda the quantity of acetic acid produced by the reaction is determined.

Action of Bromine upon Anhydrous Chloral.—A. Ogliastro.—The author expected to obtain the compound C_2Cl_5Br , or a chloro-bromide of the constitution $C_2Cl_3Br_3$, by treating, first chloral with bromine, and then making the pentachloride or chlorobromide of phosphorus act upon the compound C_2Cl_3BrO , which, according to every probability, should be formed. The action of bromine upon chloral is much more complex.

Allylate of Chloral.—A. Ogliastro.—A preliminary notice.

Transformation of Benzamide into Aldehyd and Benzoic Alcohol.—Prof. J. Guareschi.—The author added about 45 grms. of benzamide in a retort to ten to fifteen times its volume of ether, afterwards a little water, sodium amalgam, and pure and dilute hydrochloric acid. The reaction was sufficiently regular and care was taken that the liquid remained always acid, hydrochloric acid being added by degrees. To guard against a rise of temperature, the vessel was kept constantly in cold water. About 1500 grms. of sodium amalgam were employed, containing 3 per cent of sodium. When the reaction was over, the ethereal liquid was separated; it was faintly yellowish, and had an odour of bitter almonds. This liquid, distilled in the water-bath, left a residue liquid and yellowish, which had an intense odour of bitter almonds. It was agitated with 3 or 4 volumes of a solution of bisulphite of soda of sp. gr. 1.27, to separate benzoic aldehyd. The aqueous liquid, separated and decomposed with carbonate of soda, contained a small quantity of benzoic aldehyd. Having washed two or three times with water the liquid which had not combined with bisulphite of soda, it was submitted to distillation; a little water passed over first, then a portion boiling at 200° to 212° . On submitting this to fractional distillation, there was found a portion

boiling at 205.5° to 209° ; this was benzoic alcohol, its boiling-point being raised by a trace of unaltered benzanide held in solution.

Action of Sulphur on Carbonate of Lime.—Egidio Polacci.—With reference to his former paper on this subject (*Gaz. Chim.*, t. iv., p. 245), that a mixture of flowers of sulphur, distilled water, and carbonate of lime gives, in two to three hours, an intense reaction of sulphuric acid.

Production of Ozone by means of Electric Discharges.—C. Giametti and A. Volta.—Not adapted for abstraction.

Necessity of Searching for Phosphorus in the Urine in Cases of Poisoning.—F. Selmi.—The nature of this paper appears from the title.

New Studies on Milk.—F. Selmi.—An investigation into the nature of the albumenoid substances present in milk.

Behaviour of Tannic Acid in Cultivated Soils.—M. Mercadante.—The author ascribes the barrenness of lands containing much tannic acid to its power of precipitating the black matter of composts, which should keep in a free and assimilable state the salts useful to vegetation.

Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, No. 11, November, 1874.

This number contains a report on the effects of bruising oats for the food of horses, which, contrary to expectation, proved injurious rather than beneficial, the animals fed on ground oats being much more liable to sweat. The process of M. Dobelle, of Amiens, however, who merely flattens instead of grinding, is stated to give satisfactory results.

Reports on the Electro-catalytic Apparatus for Producing a Light, Invented by MM. Voisin and Dronier.—This apparatus is based on the same principle as the Doebereiner lamp, but by the intervention of electric action the catalytic effect is reinforced.

Mineral Industry at the Exhibition of Vienna, in 1873.—M. Gruner, a member of the International Jury.—A general view of the mineral statistics of the world.

Electrolytic Determination of Copper and certain other Metals.—An interesting paper which we may on a future occasion insert in full.

No. 12, December, 1874.

Mines of Pyrites of Wigsnoes, Norway.—M. F. Kuhlmann, jun.—The Wigsnoes mine is situated in the island of Karmo, on the west coast of the Scandinavian peninsula. It was discovered in 1865 by a French engineer, M. Defrance. The beds of pyrites are in contact with metamorphic schist on one side, and on the other with *gabro*, known as hyperite and euphotide, composed of a granular mass of labradorite, white, green, and violet, strongly impregnated with smarage and diallage. It contains rock crystal, titaniferous iron, and garnets. The ore is generally composed of sulphuret of iron mixed with sulphuret of copper and furrowed with blende. The gangue is silica, with a little fluor spar and chlorite. Traces of carbonate of lime are also found. The average proportion of sulphur is 45 per cent, with 3 per cent of copper, though certain parts contain 12 to 14 per cent of that metal. Specimens of metallic copper are also found. Silver and gold occur only in very small quantities. Of arsenic there is not a trace, which greatly enhances the value of the ore for the manufacture of sulphuric acid.

Les Mondes, Revue Hebdomadaire des Sciences.

No. 12, November 10, 1874.

Decolourising Properties of Phosphate of Lime.—G. Collas.—The author maintains that to treat animal

charcoal with hydrochloric acid in the hope of increasing its decolourising power by removing the phosphate of lime is an error. He admits, however, that phosphate of lime has no action upon the colouring matter of madder.

No. 13, November 23, 1874.

Explosion at a Colour Manufactory.—On Wednesday, November 18, in the works of M. Poirier, manufacturer of aniline colours on a large scale, a retort containing nitrate of methyl, destined for the preparation of a new green, and heated to a high temperature under great pressure, burst suddenly with a report comparable to the discharge of several heavy cannons. Twelve of the workmen were severely wounded, two of whom are already dead, whilst twenty others sustained slighter injuries. The explosion was heard over all Paris, at Vincennes, Meudon, and St. Germain-en-Laye. The accident is ascribed to the imprudence of a workman, who, despite express prohibition, entered the shed with a lamp.

Conditions of the Sugar Manufacture.—M. E. Pesier. Whatever may be the details and the name of the procedure adopted, it is indispensable to admit only the juice obtained by tearing and pressing the tissues; in other words, the liquor from the rasps and the presses and avoid the products of boiling the beet-root; consequently, to leave no pulp in the juice. This necessity has arisen from the employment of filter-presses. To employ for defecation a dose of lime, so as to saturate the juice. To keep the defecated alkaline juice at a boil until the ammonia is completely expelled. The injection of steam or of carbonic acid, or mechanical agitation, promotes this object. Not to neutralise all the free lime with carbonic acid. To employ animal charcoal well burnt, well washed, and free from caustic lime, from sulphides, and from chloride of calcium. To avoid every stoppage, and even slowness in the operations. Finally, to evaporate as rapidly as practicable at the lowest possible temperature.

No. 14, December 3, 1874.

M. Chevreul has given in his resignation as Director of the Museum of Natural History.

Classification and Purification of Saccharine Juices by means of Baryta and Basic Phosphate of Ammonia.—The baryta is introduced in proportions suitable to combine with the mineral and organic acids present, and eliminate them by precipitation. Basic phosphate of lime is then added to the extent of 1 to 2 litres at 10° B. for each kilo. of baryta employed, and precipitates the lime. The application of heat expels the ammonia. Excess of the reagents must be avoided. These chemicals are much superior to blood and animal charcoal, the former of which introduces the germs of fermentation.

Tanning with Chloride of Zinc.—MM. Meutens and Kresser propose to employ chloride of zinc in tanning hides, and in preparing a size for paper, incapable of putrefaction, and very slightly hygroscopic.

New Process for Converting Sulphate of Soda.—Carbon has the property of converting sulphate of soda into silicate in presence of silica, sulphurous acid and sulphur being given off. The process is conducted at a red-heat in retorts like those used for coal-gas, and heated in a similar manner. The sulphur is collected by condensation. The sulphurous acid may either be converted into sulphuric acid in the usual manner, or else it may be absorbed in carbonate of soda, yielding bisulphite of soda, which, when treated with zinc, yields the "hydrosulphite" now used in indigo dyeing.

Alcoholic Yeast.—This substance when dried can endure for some hours a temperature of 100°, and for a shorter time even 130°. In its normal state, containing water, it can endure cold amounting to -113° without becoming disorganised.

Theory of Gases.—Professor Puschl.—It is customary to ascribe the pressure of gases to the shock of their atoms

moving freely in all directions. According to this supposition, the calorific equivalent required to occasion, in a volume of gas = v , a pressure = p , will be—

$$\frac{3pv}{A}$$

A being the equivalent of duty of the calorific unity. For a gas containing no other heat, the ratio k of specific heat to the pressure constant at that heat, the volume being constant will be $\frac{5}{3}$. The maximum value found, in reality, is $k = \frac{7}{3}$, a close approximation. Clausius assumes, even in the chemical elements in a gaseous state, an internal atomic heat without influence or pressure. M. Puschl admits that a volume, v , of any fluid, submitted to a pressure, p , contains a caloric equivalent—

$$\frac{pv}{A}$$

resulting from the condensations and rarefactions of its smallest elements of volume; and that although exciting locally differences of pressure and temperature, this equivalent influences neither pressure nor temperature in their totality. Taking this calorific equivalent into account, the minimum of heat which we can suppose in a gas is—

$$\frac{5pv}{2A},$$

and not—

$$\frac{3pv}{2A}$$

as generally supposed; k , therefore, = $\frac{7}{3}$.

Electricity.—Professor Bolchmann has verified a series of formulæ relative to experiments on dielectric action at a distance, as also the dielectric constant of sulphur according to the difference of directions in reference to the optic axes in which the electricity acts. This constant, in fact, differs according to these directions, and in conformity with the theory of Maxwell, if we admit that the luminous take place normally in the plane of polarisation. The author has also determined the dielectric constant of glass, quartz, calc- and fluor-spars, and of selenium, both for permanent and alternating charges.

No. 15, December 10, 1874.

This number contains no chemical matter.

Revue Universelle des Mines, de la Metallurgie, des Travaux Publics, des Sciences et des Arts Appliqués à l'Industrie, September and October, 1874.

This number contains no chemical papers, except such as have already been noticed in the CHEMICAL NEWS from their original sources:

MEETINGS FOR THE WEEK.

- MONDAY, Jan. 11th.—Royal Geographical, 8½.
— Medical, 8.
— London Institution, 5.
TUESDAY, 12th.—Civil Engineers, 8.
— Photographic, 8.
— Anthropological, 8.
— Royal Institution, 3. E. Ray Lankester, Esq., M.A.,
"On the Pedigree of the Animal Kingdom."
WEDNESDAY, 13th.—Geological, 8.
THURSDAY, 14th.—Royal, 8½.
— Chemical, 8.
— Royal Society Club, 6½.
— London Institution, 7.
— Royal Institution, 3. Prof. P. M. Duncan, F.R.S.,
"On the Grand Phenomena of Physical Geography."
FRIDAY, 15th.—Royal Institution, 9. Prof. Tyndall, D.C.L., LL.D.,
F.R.S., "Some Acoustical Problems."

TO CORRESPONDENTS.

F. H. Storer, W. E. A. Aikin, J. Fallon, H. C. Bolton.—Received with thanks.

THE CHEMICAL NEWS.

VOL. XXXI. No. 790.

ON

ATTRACTION AND REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from page 13.)

32. WHEN the balance was in air of ordinary density, and the hot body was placed *above* the pith ball in the position *a* (see fig. 2), it will be remembered that the action was to cause the ball to rise: the rising was, however, less decided than when the heat was applied below (27, 29). On re-exhausting the balance-tube and taking a series of observations, placing the hot bulb above the pith ball in the position *a* (fig. 2) instead of below it, the ascending tendency of the pith got less and less. Several millimetres below the previously ascertained point of neutrality the hot bulb at *a* ceased to exert an action, and

marked, being exactly opposite but equal to the action of the bulb of hot water.

34. In trying some of these experiments in a Sprengel vacuum an action was noticed which led me to think that some of these movements might be due to electricity. When a hot glass rod is held motionless against the lower side of the exhausted tube, the repulsion of the pith ball takes place in a perfectly regular manner; but if the glass rod has been passed once or twice through the fingers, or if it is rubbed a few times sideways along the exhausted tube, the beam immediately moves about in a very irregular manner, sometimes being repelled from and at others attracted to the side of the tube, where it sticks until the electrical excitement subsides. When the finger is rubbed against the exhausted glass tube, the same electrical interference takes place; attractions and repulsions occur by fits and starts, the pith sticks to the tube, and does not regain its ordinary state for some hours. When a small spirit-flame is passed beneath the pith end of the balance in the vacuum, a similar but much fainter electrical effect is noticed. This, however, is not sufficient to interfere with the repulsion due to radiation unless the vacuum is very good and free from aqueous vapour.

35. The end of a glass beam in a Sprengel vacuum was found to be attracted by either pole of an induction-coil, when the other pole was not well insulated.

FIG. 4.

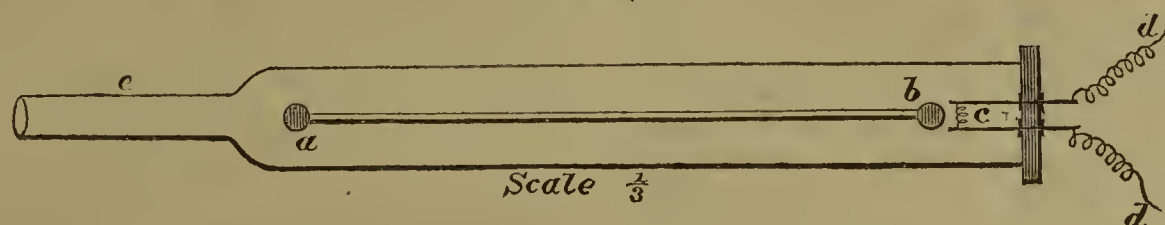


FIG. 4A.

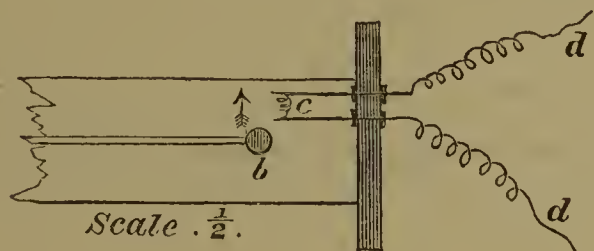
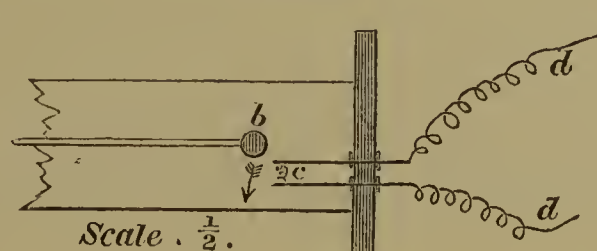


FIG. 4B.



when the neutral point was exceeded by some millimetres I could still detect no movement. However, at 2 millims. below a vacuum, I detected a tendency of the pith to sink when the experiment was tried, and in a good Sprengel vacuum there was an unmistakable repulsion exerted between the two bodies, the pith sinking in obedience to the radiation from above almost as strongly as it rose when the heat was applied beneath.

33. I now wish to ascertain the effect of cold on the balance pith balls, and for this purpose a lump of ice was employed.

The experiments were first tried with the balance-tube full of air, cold being applied either above or below the pith ball; a lump of ice generally produced an upward movement of the pith, but it was very faint, and sometimes the motion appeared to be in the opposite direction. It was evident that the true action of a cold body, whatever it might be, was here masked by currents of air; and I therefore exhausted the apparatus and tried the effect of ice at the previously ascertained neutral point, viz., at about 7 millims. below the vacuum. It was absolutely inert. I then carried the exhaustion to the fullest extent, testing the balance with ice during its progress. As the gauge approached nearer and nearer to the height of the barometer, the ice commenced to attract the pith; and at last, when the gauge and barometer were level, the attraction of the ice, whether applied above or below, was very

To ascertain whether electricity exerted any special action in the ordinary repulsions in vacuum, the following experiments were tried:—

36. A straw beam with pith extremities was enclosed in a tube (24) and exhausted to the full power of the Sprengel pump. After adjustment by heat, till it was in equilibrium and very delicate to slight radiation, it was re-exhausted and hermetically sealed up. The tube was then completely surrounded with wet blotting-paper, with the exception of a small aperture through which the movement of the beam could be observed; the blotting-paper was connected to earth by a wire soldered on to a gas-pipe.

On bringing a piece of warm copper beneath the pith ball, it rose as readily as if the outside of the tube had been dry and insulated. The finger moistened with warm water also repelled the pith; and when cooled with melting ice, and then applied dripping wet either above or below the pith ball, there was attraction. The same result, but more strongly marked, took place when a piece of ice was used instead of the cold finger.

A straw beam furnished with brass balls at each end* was suspended in the usual manner on a double-pointed needle; and the brass balls and needle were placed in metallic connexion by means of a very fine platinum wire. The needle did not rest on the sides of the glass

* From the *Philosophical Transactions of the Royal Society of London*, vol. clxiv., par 2.

* Preliminary experiments showed me that the brass balls on the straw beam acted in every respect the same as the pith balls, with regard to hot and cold bodies externally applied, both at ordinary pressures and in a vacuum; but they moved in a more sluggish manner.

tube but in steel cups, to which was soldered a platinum wire passing through the glass tube and connected to earth. The tube was then exhausted, and the usual experiments tried with hot and cold bodies, both with and without a wet blotting-paper cover. In all cases the brass balls behaved normally, being repelled by heat and attracted by cold.

These experiments show that electricity is not a chief agent in these attractions and repulsions, however much it may sometimes interfere with and complicate the phenomena.

37. I now wished to see the effect of applying to the gravitating masses a hot body inside the exhausted balance-tube instead of outside, and accordingly constructed an apparatus shown in fig. 4.

a, b are two balls suspended on a straw beam; c is a platinum spiral fastened to two stout copper wires cemented into holes drilled through a plate of glass, which can be cemented to the end of the tube; d, d are the battery-wires: e is the extremity of the tube, drawn out for attachment to the Sprengel pump. A single Grove's cell served to heat the platinum spiral to redness. By careful management and turning the tube round the necessary degree, I could place the equipoised brass ball either over, under, or at the side of the source of heat. A contact-key enabled me to heat the spiral without removing the eye from the micrometer. With this apparatus I wished to learn more about the behaviour of the balance during the progress of the exhaustion, both below and above the point of no action, and also to ascertain the pressure corresponding with this critical point.

In air of ordinary density the action of the hot spiral was one of attraction both above and below. Not wishing, however, to complicate the action by air-currents, I exhausted with the Sprengel pump until the gauge stood about 40 millims. below the barometer. I then tried the following experiments:—

38. The brass ball was placed so that its position when in equilibrium was about 1 millim. above the spiral, and the latter was rendered incandescent. The ball was immediately drawn down to the spiral, sometimes touching and then rebounding with considerable force.

39. The brass ball was then arranged so that it was about 1 millim. below the spiral. On turning on the battery-current the ball rose to the hot platinum. This latter action might be due to air-currents; but it is difficult to imagine that air-currents could drag the ball down to the hot spiral when the latter was beneath it (38).

40. The ball was arranged so that the platinum spiral was opposite the end, but a little above, as shown in fig. 4A. On igniting the spiral the movement was very slightly upwards. When the spiral was rather below the ball, as shown in fig. 4B, the ball moved downwards when contact with the battery was made; the tendency in each of these cases was to bring the centre of gravity of the brass ball as near as possible to the source of heat.

41. The pump was then worked until the gauge had risen to 5 millims. of the barometric height. On arranging the ball above the spiral and making contact, the attraction was still strong, drawing the ball downwards a distance of 2 millims.

The pump continuing to work, the gauge rose until it was within 1 millim. of the barometer. The attraction of the hot spiral for the ball was still evident, drawing it down when placed below it, and up when placed above it. The movement was, however, much less decided than before, and in spite of previous experience (30, 31) the inference was very strong that the attraction would gradually diminish until the vacuum was absolute, and that then, and not till then, the neutral point would be reached. Within 1 millim. of a Sprengel vacuum there appeared to be no room for a change of sign.

42. The gauge rose until there was only half a millimetre between it and the barometer. The metallic hammering heard when the rarefaction is close upon a vacuum commenced, and the falling mercury only occa-

sionally took down a bubble of air. On turning on the battery-current, there was the faintest possible movement of the brass ball in the direction of attraction.

43. The working of the pump was continued. On next making contact with the battery, no movement of the ball could be detected. The red-hot spiral neither attracted nor repelled. I had arrived at the critical point. On looking at the gauge I saw it was level with the barometer.

(To be continued.)

LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE

CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

LECTURE III.

HAVING thus far treated of some of the simplest relations of crystal faces as referred to a system of axes crossing one another at right angles, the lecturer proceeded to indicate the methods by which such relations may be also established between the faces where either no axes perpendicular to each other are furnished by edges of the crystal, or where, for other reasons, axes oblique to each other are selected. And, first, he pointed out the general features of a crystallographic axial system. Such a system will present, in its most general form, three axes, X, Y, Z , inclined to one another, at angles—

$$XY = \zeta$$

$$YZ = \xi$$

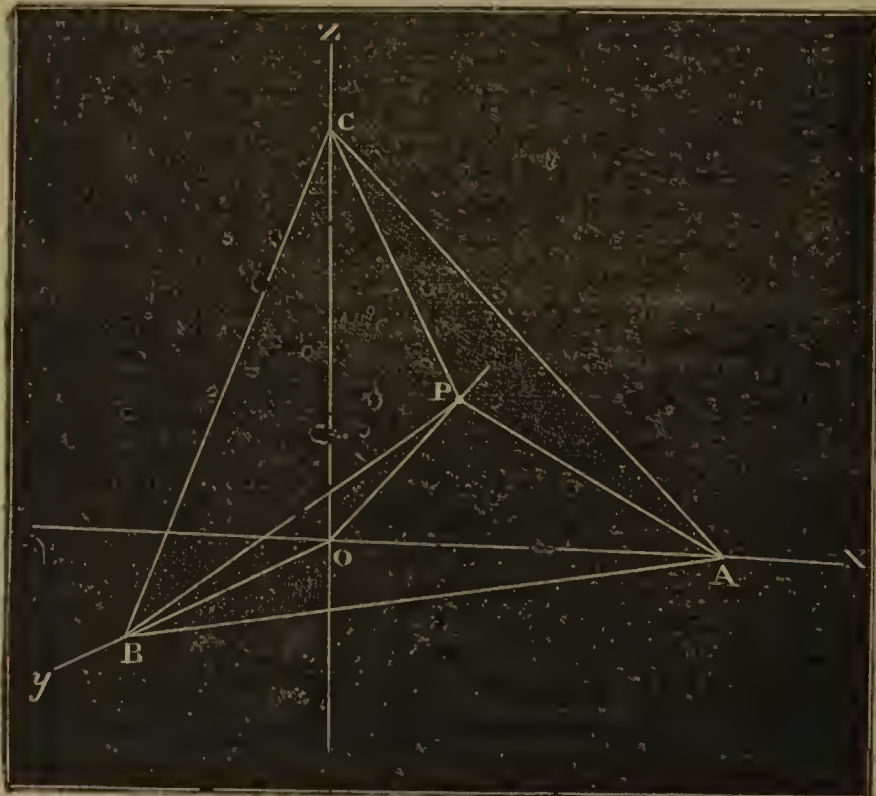
$$ZX = \eta$$

The parameters, also, in the most general case, $a : b : c$, represent two quantities, viz., $\frac{a}{b}$ and $\frac{c}{b}$, which will give the ratios of the intercepts of some assumed plane, viz., $\frac{a}{b}$ on the axis of X , 1 on the axis of Y , and $\frac{c}{b}$ on the axis of Z ; hence, such a system presents five elements, viz.:—

$$\zeta, \eta, \xi; \frac{a}{b}, \frac{c}{b}.$$

It will also be observed that the space around the origin of the axes is divided by the three axial planes, XY ,

Fig. 3.



YZ, ZX , into eight spaces, or compartments, termed octants, which may be characterised by the signs of the axes that include them.

The simplest way of referring the face of a crystal to such an axial system is by supposing a line to be drawn perpendicular to the face from the origin, as in Fig. 3. The line OP is drawn perpendicular to the plane ABC . Drawing the lines PA , PB , and PC , the triangles OPA , OPB , and OPC give us the following ratios:—

$$\frac{OP}{OA} = \cos. POA, \quad \frac{OP}{OB} = \cos. POB, \quad \frac{OP}{OC} = \cos. POC,$$

or $OP = OA \cos. POA = OB \cos. POB = OC \cos. POC$. So another plane, HKL , would give the values—

$$OP' = OH \cos. P'OX = OK \cos. P'OY = OL \cos. P'OZ,$$

in which expressions OA , OB , OC are the parametral ratios $a:b:c$, while OH , OK , and OL have values like those before obtained for the comparison of two planes, viz:—

$$\frac{a}{h}, \quad \frac{b}{k}, \quad \frac{c}{l};$$

and, reverting to the original example, the plane 341 would be represented by the expression—

$$\frac{a}{3} \cos. P'X = \frac{b}{4} \cos. P'Y = \frac{c}{1} \cos. P'Z,$$

P' being the point where the perpendicular to the plane, henceforth to be called its *normal*, meets it: and the expressions previously obtained for an edge, a zone line, or a zone, are equally applicable when the axes are taken as oblique.

The next step to be taken is to extend this idea of normals drawn to all the planes of a crystal to that of their continuation until they meet the surface of a sphere which is supposed to be described round the origin of the axial system as its centre. The faces of the crystal may be conceived as drawn so as to be tangent planes to such a sphere; or, again, we may suppose their normals to be continued onwards through the planes until they penetrate the sphere's surface. In either case, the points at which they meet that surface will be termed the *poles* of those planes.

It is evident that by this means the situation of a plane is known when we know that of its pole upon the sphere. Any great circle of the sphere passing through a pair or a series of such poles will offer, in the arcs intercepted between them, the means of measuring the angles between their normals, which were shown to be supplementary to the angles between the planes themselves. Such circles connecting two or more poles will be called zone-circles, and they will evidently lie in the zone-planes of the zones by which they are designated. The calculation of the arcs of these great circles falls within the domain of spherical trigonometry.

The lecturer next made a digression into the subject of the different methods employed for the graphic representation of crystals; and, after alluding to the usual orthographic representation of their edges in the pictures met with in crystallographic treatises, he proceeded to consider the simple and comprehensive method afforded by projecting their poles in what is termed the stereographic projection. The eye, being supposed to look into the sphere from a point on its surface, sees the poles distributed on the hemisphere opposite to that point, as though depicted on a screen passing through the centre of the sphere, and bounded by the great circle of which the position of the eye would be the pole. All great circles of that opposite hemisphere are now projected on the plane dividing the sphere as circular arcs, except such as pass through the pole opposite to the eye, which are presented as straight lines passing through the centre of the circle of projection.

These points were illustrated by a working model, as were also the means of measuring arcs on a projected circle by drawing lines from its projected pole to the circle of projection. Methods for finding the centres for these projected arcs were also illustrated by the model in question.

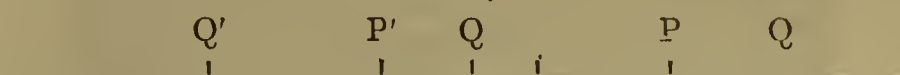
The lecturer finally dwelt on the great importance to

the student of familiarising his hand to the construction of projections of this kind, and his mind to the recognition, in the poles on the sphere, of the true relative positions of the faces of which they were the representatives; a familiarity easily acquired, and when acquired, facilitating the working of crystallographic problems, and the embodying within the outline of a single circle even the most complicated series of faces a crystal can present with a completeness offered by no other method.

LECTURE IV.

Mr. Maskelyne began his fourth lecture by a digression, in which he called attention to certain properties presented by the division of a line by three or more points. Supposing a line of indefinite length to have two points upon it, P and P' (Fig. 4), and supposing a third, and movable,

FIG. 4.



point, Q , to traverse the line in a direction towards P and P' , then at any position of Q before it reaches P we have the ratio—

$$\frac{QP}{QP'} = \frac{QP' - PP'}{QP'} = 1 - \frac{PP'}{QP'},$$

and this ratio, when Q and P coincide, becomes zero; while, on the other hand, when Q was indefinitely remote from P , the fraction—

$$\frac{PP'}{QP'}$$

approximates to 0, so that the decrease of the ratio was continuous from 1 to 0, as Q moved towards P . Beyond P , as Q moves towards P' , the ratio continuously increases until $QP' = 0$, that is to say, Q and P' coincide, and the ratio becomes infinite, and midway between P and P' it obviously passes through the value—

$$\frac{QP}{QP'} = 1.$$

Beyond P' again, let Q become Q' ; and now the ratio—

$$\frac{Q'P}{Q'P'}$$

continuously decreases from infinity to 1, as—

$$1 + \frac{PP'}{Q'P'}$$

approximates to 1 + 0.

If now we consider the ratios of the parts into which the line is divided internally to PP' by Q , and externally by Q' , these ratios—

$$\frac{QP}{QP'} \quad \text{and} \quad \frac{Q'P}{Q'P'}$$

offer us a series of values, among which, for every position of Q' , there may also be found one corresponding position of Q , such that—

$$\frac{QP}{QP'} = \frac{Q'P}{Q'P'};$$

and this is what has long been known as the harmonic division of the line.

Reckoning magnitudes as positive in the direction PP' , and negative in the direction $P'P$, we have—

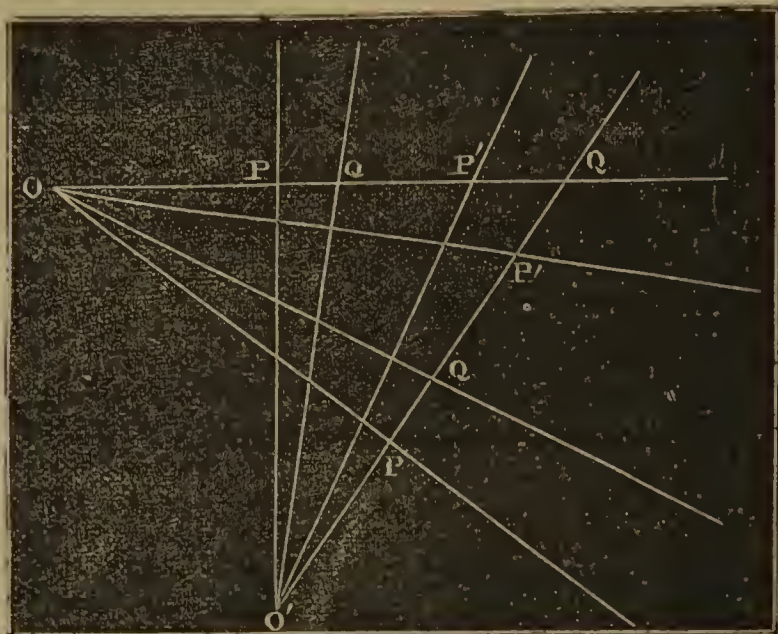
$$\frac{PQ}{PQ'} = -\frac{P'Q}{P'Q'} \quad \text{or} \quad \frac{PQ}{PQ'} : \frac{P'Q}{P'Q'} = -1.$$

This equality of the ratios, however, is only a particular case of that more general proportion with which we have to deal.

Mr. Maskelyne then proceeded to state some of the more general properties presented by what have been called anharmonic ratios by M. Chasles. Thus, if four rays are drawn through a point, and any line cut these

transversely in points P, Q, P', Q', the ratios in question remain the same, whatever be the direction taken by the transverse line. And if four other rays (Fig. 5), proceeding from another point, meet the former four severally at right angles, the ratios are the same for each sheaf of

FIG. 5.



rays; and, further, the sines of the angles contained by these rays, taken in the same order as the points on the original transverse lines, have also identical ratios with the corresponding divisions on a transverse line.

LECTURE V.

In reverting to the subject discussed in the last lecture, Mr. Maskelyne showed that, if two of the rays in a sheaf of four be perpendicular to each other, and one of them bisect the angle between the remaining two, the ratios of the sines of their angles become harmonic.

Reverting from this digression to the subject of a zone, and considering the radii of a sphere drawn to a series of poles on the same zone circle, which represent, therefore, the normals of the planes of that zone, he stated, as one of the many contributions of Professor Miller to crystallographic science, that he had shown that the anharmonic ratios of the sines of the angles between any four such normals are identical in value with the corresponding ratios of the determinants of the symbols for the four planes. Consequently, we may say that the anharmonic ratios yielded by the normals of four tantozonal planes, and, therefore, also by the planes themselves, must in a crystal be rational, since the symbols of the planes involve only rational numbers. This is a result of the greatest importance, as limiting the kinds of symmetry that are possible in crystals, as will be hereafter seen.

Another important result of this great principle—a principle which, in fact, is only another way of stating the fundamental crystallographic law—is, that we are hereby enabled to deduce relations of great practical value between the angular inclinations and the symbols of four tantozonal planes; the expressions relating to three planes only in a zone not being capable of affording this result.

From what was said at the opening of this lecture, it now becomes clear, as an illustration of this point, that if one plane in a zone is equally inclined on two other planes in it (Fig. 6), a plane perpendicular to the first must be a possible plane of the zone, since the normals of the four planes form a harmonic sheaf of lines, and *vice versa*.

Proceeding to discuss the conditions requisite for three successive angles between the planes of a crystal zone being equal, Mr. Maskelyne showed that we come to an expression that limits the values of this angle ϕ to such in which $\cos. \phi$ is rational, and this can be further shown to be true only in cases where ϕ has one of the four values, 90° , 45° , 60° , or 30° .

Future lectures, which will deal with the subject of crystal symmetry and the actual forms and systems that crystals may present, will be mainly concerned with the results that

flow from this important principle, which has thus been arrived at by a series of steps established, or in some cases only asserted to be capable of proof, in preceding lectures.

Even to those who, from unfamiliarity with solid geometry, may not have made good these successive links in

FIG. 6.



a continuous chain of reasoning, will at least have become accustomed to the ideas and the terms expressing them which even the exoteric crystallographer has to make his own; and with this preparation we can enter at once on the subject of crystal symmetry.

(To be continued.)

ON THE
COMPOSITION OF THE FATTY MATTER OF
WOOL.

By E. SCHULZE and A. URICH.

IN a former communication, one of us has shown that, along with free cholesterin, compound ethers of cholesterin and of ischolesterin are found in the grease of wool. The question as to the composition of wool-fat could not be fully solved with the data which we formerly obtained. From the elementary composition of the crude mixture of the wool-grease alcohols, it appeared that, in addition to cholesterin and ischolesterin, another alcohol, poorer in carbon (or a number of such) must be present. We have, therefore, examined two fresh kinds of wool-grease. The one, which we shall designate as *b*, was obtained from the raw wool of North German sheep, by extraction with ether; the other, *c*, was obtained in the same manner from the raw wool of a Swiss mountain sheep. From that portion of both samples which was readily soluble in alcohol it was easy to separate pure cholesterin, and it was proved that this compound was chiefly present in the free condition. The portion of *b* not readily soluble in alcohol yielded, when decomposed with alcoholic potash along with potash soaps, a mixture of wool-fat alcohols, resembling the product obtained from the wool-grease formerly examined. Along with cholesterin was found ischolesterin, apparently in equal quantity. It was separated from cholesterin by the method which we previously employed.

Isocholesterin was also found in *c*, but in a relatively small proportion. When, therefore, the mixture of wool-grease alcohols which separated from the sparingly soluble portion of the sample had been dissolved in an excess of spirits of wine, at first only cholesterin crystallised out of the solution on cooling, without an admixture of ischolesterin. The latter was subsequently deposited from the mother-liquor. Our attention was mainly concentrated

upon obtaining the alcohols poorer in carbon. From the results of our previous researches, it seemed that this substance was only present in wool-grease in a small quantity, for it had not been possible to obtain, from the mixture of benzoic ethers, besides benzoic cholesterin-ether and benzoic ischolesterin ether, a third compound in quantity sufficient for examination. A third kind of ether, however, might escape observation if soluble in spirit of wine, even though present in larger quantity. We have, therefore, when continuing our researches, converted a part of the wool-grease alcohols (from the sparingly soluble portion of *b*) into benzoic ethers by prolonged fusion with anhydrous benzoic acid. In this case it may be safely inferred that none of the alcohols remain uncombined. The resulting mass was freed by proper treatment from the excess of anhydrous benzoic acid and from the hydrous benzoic acid which had been formed. The residue then contained all the wool-grease alcohols in combination with benzoic acid. Of this residue, about 20 per cent was soluble in hot spirit of wine. The solution deposited oily drops which, even when perfectly cold, remained soft and amorphous. They consisted of a benzoic ether, differing widely in its properties from the benzoic ethers of cholesterin and ischolesterin. From these two compounds it can be separated with tolerable completeness by extraction with cold acetone.

On decomposition with alcoholic potash, this compound yielded, along with benzoate of potash, an alcohol which readily dissolved in ether, acetone, and spirit of wine, but did not crystallise from any of these solvents. It melts at a gentle heat, and cannot be distilled without decomposition. A substance of quite similar properties was also obtained from the portion of wool-grease readily soluble in alcohol. It contained 80.14 per cent of carbon, and 12.29 per cent of hydrogen.

Three alcohols can, therefore, be isolated from wool-grease—cholesterin, ischolesterin, and an amorphous alcohol. The properties of the last-mentioned body afford no certainty that it is a definite chemical compound. It may consist of a mixture of several alkaloid bodies. Among the acids separated from the wool-grease, oleic acid seemed present in considerable quantity, but it was not obtained in a state of purity. The quantity of the fatty acids was not sufficient for complete decomposition by the method of fractionated precipitation; however, the presence was proved of a fatty acid with a very high equivalent, perhaps identical with the hyaenic acid of Carius.

One hundred parts of the above-named portion of the wool-grease, *b*, yielded 53.1 parts of wool-grease alcohols. This number is in favour of the supposition that the sparingly soluble portion of this wool-grease only consists of compound ethers. For 100 parts of a mixture (in equivalent proportions) of oleic cholesterin ether, stearic cholesterin ether, and the corresponding ischolesterin compounds, would yield, on decomposition, 58.8 parts of cholesterin+ischolesterin. 100 parts of the analogous oleic and hyaenic compounds would produce 52.5 parts of cholesterin+ischolesterin. The presence of the amorphous alcohol in the mixture would not make much difference in the quantity of alcohol obtained on decomposition, since, judging from the composition of its benzoic ether, it combines with as much acid as does cholesterin.

With the sparingly soluble portion of the grease *c* the case was different. 100 parts yielded 47.1 parts of wool-grease alcohols. This quantity is not sufficient to saturate the acids present. A portion of the latter must, therefore, be present in a free condition, and, in fact, that alcoholic extract of this grease has a strongly acid reaction. As was formerly mentioned, on the decomposition of the sparingly soluble portion of the wool-grease earlier examined alcohols and acids were found in such proportions that the presence of free fatty acids was suspected. But this assumption could only be regarded as doubtful, since the question still remained why these free acids were not removed by treatment with spirit of wine. This can now be explained, since it has been shown that in wool-grease there occur fatty acids of high equivalents and sparingly soluble.

The bulk of wool-grease, therefore, consists of compound ethers, but a part of the alcohols (cholesterin, at least), and occasionally of the fatty acids, are in a free condition.

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, December 15, 1874.

EDWARD SCHUNCK, PH.D., F.R.S., &c., President, in the Chair.

MR. JOSEPH CARRICK and Professor Morrison Watson, M.D., were elected Ordinary Members of the Society.

"Analysis of one of the Trefriw Mineral Waters," by THOMAS CARNELLEY, B.Sc. Communicated by Professor H. E. ROSCOE, F.R.S., &c.

An analysis of this strongly ferruginous mineral water has not, so far as the author has been able to learn, been published before any scientific Society; and though two general analyses of it have previously been made, the first by Mr. D. Waldie, in 1844, and the second by Dr. Hassall in 1871, and published in the form of pamphlets for public reading by Dr. Roberts and Dr. Hayward respectively, yet as it is peculiar for the extremely large quantity of iron and alumina that it contains, and as its composition has varied considerably since it was analysed by the last named chemist (whose results also varied from those of the first), it is thought that another and more complete analysis will not be out of place.

The village of Trefriw is situated on the left bank of the Conway about 2½ miles from Llanrwst and between the latter place and Conway. The springs, which now belong to a company and are often visited by invalids, as they are said to be good for the cure of diseases of the digestive organs and of the skin, are close to the high road which runs between Conway and Llanrwst, and are rather over a mile from the village. The entrance to them is a short way up the side of the mountain called the Alt cae Coch, and consists of an underground passage cut in the rock. There are at present two springs (formerly there were three), one opposite and close to the entrance, the other at the end of a gallery 10 or 12 yards long to the right. The former water is used to supply the baths, and the latter exclusively for drinking; they differ considerably in the relative proportions of their mineral constituents, but it is only the last named which is the subject of this paper.

The water, which flows into a basin cut in the rock, is said to be uniform in quantity and issues at the rate of about 40 gallons per hour; its temperature varies only within very narrow limits and is quite cold. As it occurs in the spring it is perfectly clear, bright, and colourless; but after a short exposure to the air it turns yellow and deposits flakes of ferric oxide; it has no smell, but possesses a strong and very disagreeable inky taste. On being shaken up in a closed bottle no disengagement of gas takes place; it has a strongly acid reaction, and contains neither free carbonic acid, carbonates, nor sulphides; and when first taken from the spring is perfectly free from ferric salts.

The following (I.) is the analysis made of the water collected by the author on September 8th, 1874, together with that (II.) made by Dr. Hassall in the early part of September, 1871,* or just three years previously.

Temperature of the external air	.. ..	15.5° C.
" " air at the spring	.. ..	12.5° C.
" " water	.. ..	11.0° C.

* See "Guide to Trefriw and Vale of Conway Spa," by Dr. W. Hayward, M.D., M.R.C.S. Second edition.

	I.	II.
Specific gravity at 17° C. ..	1·00716	1·00570
	Parts per 1,000,000.	
Loss on ignition	7217·5	—
Precipitate formed on boiling one hour	32·8	—
Iron	1507·0	2009·4
Aluminium	233·3	112·4
Calcium	271·3	116·5
Magnesium	134·1	45·4
Potassium	31·5	—
Sodium	25·1	15·3
Manganese	trace	trace
Lead	0·86	—
Ammonium (NH ₄)	1·63	—
Albumenoid ammonia	0·34	—
Silica (SiO ₂)	157·0	149·0
Sulphuric acid (SO ₄)	4985·3	4512·0
Chlorine	11·8	10·9
Nitric acid (NO ₃)	9·1	—
Phosphoric acid (PO ₄)	2·45	—
Total solid contents	7370·78	6970·9
The residue dried at 310° C. ..	7370·00	—

The following table represents the above in combination :—

	I.	II.
Ferrous sulphate	4090·4	5454·3
Aluminium sulphate	1358·9	700·7
Calcium sulphate	922·3	376·0
Magnesium sulphate	670·3	225·7
Potassium sulphate	70·3	—
Sodium sulphate	49·9	47·0
Lead sulphate	1·25	—
Calcium chloride	—	16·8
Sodium chloride	19·4	—
Sodium nitrate	4·8	—
Ammonium nitrate	7·2	—
Aluminium phosphate	3·2	—
Manganese	trace	trace
Silica	157·0	149·0
Albumenoid ammonia	0·34	—
Bases for which there is not sufficient acid	15·5	1·4 Loss
	7370·79	6970·9

With reference to this analysis the following observations are to be made :—

(1). The determination of the total residue was first made at 180° C., as recommended by Fresenius,* and the result obtained corresponded to 8100 parts per 1,000,000; it was found however that this was much too high, the reason being that ferrous sulphate, though it loses six molecules of water at 114° C., yet retains the seventh even at 280°†. In order to drive off this remaining molecule, the residue from 100 c.c. of water was heated in an air bath to 300°—310° and weighed; after repeated heating two successive weighings did not differ by more than a milligramme. In heating to so high a temperature, however, there is a danger of a little sulphuric acid volatilising by decomposition of the sulphate of iron, but by careful heating this may be avoided; a loss of ammonia will, nevertheless, have been incurred, but as this, together with the trace of organic matter, did not amount to more than 8 to 10 parts per 1,000,000, it was not of very much consequence.

(2). It will be seen from the table showing the supposed combination of the salts, that the total bases formed were rather more than sufficient to combine with the acids, and the base which is given above as uncombined is alumina, as it is thought that the quantity of this body obtained was rather too high, for, in addition to the total bases

being too large for the total acids, the sum of the oxides (Fe₂O₃+Al₂O₃+P₂O₅) calculated from the Fe, Al, and P₂O₅, each estimated directly, is rather greater than the result obtained by weighing the three oxides together, the numbers being 2592 and 2570 respectively—difference 22.

(3). In the determination of the alumina it was separated from the iron by means of tartaric acid and sulphide of ammonium, and weighed as Al₂O₃+P₂O₅; the difference between this and the determined amount of P₂O₅ gave the quantity of alumina.

(4). The phosphoric acid was estimated by precipitating with ammonium molybdate, and as the amount was only small, by weighing the precipitate obtained on a constant filter; the calculation was then made from the composition of the precipitate, which contains, according to various authorities, 3·142 per cent. P₂O₅.

(5). The iron was determined directly at the spring with potassium permanganate, and afterwards gravimetrically in the laboratory. The results obtained agreed very nearly.

(6). Several determinations were made of the alkalies, but rather varying results, comparatively, could only be obtained for the sodium. The above is the mean of four, of which the highest was 32 and the lowest 22 parts per 1,000,000, the reason being that the quantity of sodium present was only very small, so that the traces of it also contained in the reagents had an appreciable effect, though they were as pure as could be obtained. The results got for the potassium, however, agreed very nearly.

(7). The lead was determined by the method given in Wanklyn and Chapman's "Water Analysis," as were also the ammonium, albumenoid ammonia, and nitric acid.

By a comparison of the above two analyses it is evident that between September, 1871, and September, 1874, the composition of the water has varied considerably, and though the author has not had an opportunity of seeing the analysis made in 1844 by Waldie, yet from Dr. Hassall's report, given in the above-mentioned pamphlet, it would seem that the results there given also vary much from those obtained by Waldie. The quantity of iron appears to have greatly diminished, while, with the exception of SiO₂ and chlorine, that of the other constituents occurring in larger quantities has considerably increased. A determination of the iron made last February gave 1575·4 parts per 1,000,000, though in this case the determination was not made till after the water had been collected some days. From this it would seem that the iron is gradually diminishing in quantity. The result, however, obtained by Waldie is very nearly the same as that got by Hassall.

From the analysis it will be seen that the Trefriw water is peculiar, as already mentioned, on account of the large quantity of sulphate of iron which it holds in solution; there being, so far as the author has been able to learn, no spring in the United Kingdom, and perhaps not even on the Continent, which contains it in anything approaching to the same amount, while there are only a few springs known which contain it even in a notable quantity, the analyses of which have been described. The water is also remarkable for the large quantity of sulphate of alumina and silicic acid which are dissolved in it, while the phosphoric and nitric acids, though existing only in small amounts, are rather large compared with what is found in most other mineral waters; on the other hand, the proportion of chlorine is only small.

The other Trefriw mineral spring was not analysed, but from Dr. Hassall's analysis of the two waters, it appears to contain less iron and alumina, but a larger quantity of alkalies and alkaline earths than the one which is the subject of this memoir.

With regard to the geological position of Trefriw, and the source of the mineral impregnation of the springs, it may be observed that the mountains at the base of which the wells are situated consist chiefly of beds of limestone, ironstone, alum slate, and iron pyrites, together with varying proportions of silicates, very much fractured and dis-

* Fresenius, "Quantitative Analysis." 4th Edition, p. 560.

† Watts, "Dictionary of Chemistry," vol. v., p. 597.

located, forming the northern extremity of the Bala or Caradoc beds. Up in the mountains and on these beds lie some small lakes from which the springs are supposed to derive their principal supply of water, which, after percolating through the above beds and dissolving large quantities of their constituents, finds its exit near the base of the mountain Alt cae Coch, where it issues from the slate bed (Black Band), and between it and the ironstone. From the above data the composition of the water is easily accounted for. There are several pyrites mines in the vicinity, one of which is situated just over the springs, but much further up the mountain side.

The author has been indebted for Dr. Hassall's analysis and some of his remarks relative to the geological position of the springs to the pamphlet of Dr. Hayward previously mentioned.

NOTICES OF BOOKS.

THE TESTING OF ARTIFICIAL COLOURS.

Die Chemische Prufung der kunstlichen organischen Farbstoffe. Von Dr. FERD. SPRINGMÜHL. Leipzig: Weigel.

DR. SPRINGMÜHL, the editor of the *Musterzeitung* lays before the scientific and technological public, in this pamphlet, an account of the incidental impurities and intentional sophistications occurring in artificial colouring matters, and directions for their detection. Natural organic dyes are to be considered in a future treatise. We may mention as a somewhat disappointing circumstance, that while the introduction leads us to expect some mention of the colouring matters of uric acid and of the alkaloids, they are omitted in the body of the work. As regards picric acid the author finds that oxalic acid is not merely present in many samples as an incidental by-product, but is sometimes intentionally added to the extent of 20 per cent. Samples of phenyl-brown are sometimes largely adulterated with sawdust and fragments of lignite (brown-coal). Oxalic acid and dinitrophenol are also present.

The poisonous properties ascribed to corallin, and to goods dyed with this colour naturally called for the author's attention. He pronounces pure corallin not more poisonous than the remaining phenyl-colours, but finds that it may contain aniline, iodine, mercuric chloride and especially carbolic acid, to which latter he ascribes a great part of the toxic phenomena observed in the case of this dye. For the detection of carbolic acid in corallin he recommends Landolt's test. The sample is dissolved in water, held up to the light and mixed with bromine water. If carbolic acid is present a precipitate or turbidity of tribromphenol appears. Aniline, however, if present, is thrown down at the same time.

In his general remarks on the aniline colours the author informs us that:—French qualities are the most frequently adulterated, whether by the manufacturers themselves or by middlemen. English samples, as far as I have had the opportunity of observing, are distinguished by great purity and excellence."

Out of 25 specimens of magenta one only was found free from arsenic. In 14 the amount was sufficient for quantitative determination. In four samples the proportions were respectively 6.5, 5.9, 5.9, and 5.1 per cent. Such qualities, of course, must prove dangerous if used for colouring liqueurs, confectionery, and toys. In dyeing, however, the amount of the poisonous matter which attaches itself to the wool is relatively trifling. This the author ascertained by an interesting experiment. In a beaker he dissolved 0.1 gramme of the most poisonous sample in hot water. The solution, of course, contained 0.0065 gramme of arsenic. In it a square foot of pure wool (woollen tissue) was dyed. It was then well rinsed in a second beaker of pure water, and again in a third. The dyed wool, the residual dye, and the two wash-waters

therefore contained 0.0065 of arsenic, and it remained to ascertain its distribution. In the dye-bath were found 0.0051 gramme, in the first washing-water 0.0010. In the second washing-water the amount was too small to be determined. It, however, and the dyed wool must together contain the residue 0.0005. According to Marsh's test the wool appeared to contain less than the second washing water. Hence a square inch of the woollen could contain scarcely two millionths of a gramme of arsenic. If the proportion of arsenic is low, as in well-purified magentas, the wool, when dyed gives no indications by Marsh's process. It is of some importance to know of what salt of rosanilin a commercial magenta consists, as the proportion of base varies, the muriate being richer than the acetate.

The mercurial process for the manufacture of magenta is still used in some establishments. The author found the crystals of such samples smaller than those of arsenical magentas. Two of the specimens examined contained arsenic, which renders their origin doubtful. In none was mercury detected.

The two most frequent adulterants are oxalic acid and sugar. The author has found 21 per cent of the former, and 24 per cent of the latter. Joly has detected sugar to the extent of 50 per cent.

Aniline violets are more liable to sophistication than magentas from the fact that they are sold, not in well-defined crystals, but in powder or in cakes. The author has detected gum in a Hofmann's violet to the amount of 12 per cent, and 8 per cent of finely ground charcoal in a common phenyl violet.

Aniline blues are treated very briefly. The author does not specify any adulterations as having actually occurred in his investigations, but he recommends consumers to have an eye to the possible presence of sugar.

Of 32 samples of iodine-green examined, 5 were unquestionably sophisticated. One contained 18 per cent of sugar. An English sample was cleverly sophisticated with a salt of lead, probably the picrate, and deflagrated when a portion was heated upon platinum foil. Metallic lead was found to the extent of 10 per cent, corresponding to 21 per cent of the picrate. Two other samples contained respectively 14 per cent. of common salt and 26 per cent of magnesia. Oxide of chrome is also a possible adulteration.

The finest sample of iodine-green examined was from the manufactory of H. Siegle, in Stuttgart. The author considers that in the production of this beautiful and costly colour the Germans are superior to the English and the French.

We shall probably again return to this book on some future occasion. Meantime we feel bound to call to it the especial attention of such of our readers as are connected with dyeing, calico printing, or the manufacture of colours.

CORRESPONDENCE.

MANUFACTURE OF EXTRACT OF INDIGO.

To the Editor of the Chemical News.

SIR,—I have looked in a great many books for information on the manufacture of extract of indigo, but there is no real practical information on it. I contribute this as a help to the human kind.

To make what is generally called *sour extract of indigo*, mix 5 lbs. of best Bengal indigo in 30 lbs. of strong oil of vitriol. Let it stand five days; then put it in a tub and add 40 gallons of boiling-water to it; then filter while hot through strong felt cloth. The filters are usually made this way:—A frame like a table-top, 8 yards long, 2 yards wide. This frame is divided into four filters. Pieces of wood across are put on the top and made to fit the holes

(the shape of bowls, with small holes perforated in them); then the felt cloth is put on the top, and the liquid is put on the filter and filtered through. The sediment at the top is used to colour pottery moulds; that which runs through is put in a tub, and 40 lbs of common salt added. Digest for six hours; then put on the filters again for four or five days. That which drains through runs away into the sewers; that on the top of the filters is the extract. For these proportions the extract should weigh 80 lbs. This is sour extract of indigo of commerce.

Free Extract.—To make free extract of indigo, put 100 lbs. of the sour extract in a tub, 12 gallons of water as well. Neutralise the acid in the extract with strong soda-ash liquor until it is free from any sour taste; then put on the filters for six days. It should weigh 100 lbs. when it comes off. That is free extract of indigo of commerce. —I am, &c.,

BRADFORD.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE. All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 24, December 14, 1874.

Determination of the Speed of Light and of the Solar Parallax.—M. A. Cornu.—The author finds the speed of light in a vacuum = 300400 kilometres per second of mean time, the probable error being below the one-millionth part.

Observations on the Reproduction of the Phylloxera of the Vine.—M. Balbiani.—A very lengthy paper; not adapted for abstraction.

The American Species of the Genus Phylloxera.—C. V. Riley.

Method Taken for the Discovery of the Substance most Efficacious for Combatting the Phylloxera at the Viticultural Station of Cognac.—M. Max Cornu.

Experiments made upon Healthy Vines with Poisonous Substances.—M. Baudrimont.

Observations on a Recent Communication by M. Volpicelli on the Electric Influence.—M. E. Blavier.—In the *Comptes Rendus* for November 16 appears a note on electric influence, in which M. Volpicelli cites several experiments, the results of which appear to him opposed to the received theory. The author maintains that the facts in question are perfectly conformable to the theory as established by M. G. Green in 1828, and expounded in the "Theorie Mécanique de la Chaleur" of Briot. Two conductors, placed in connection by means of a metallic wire, assume the same potential or the same tension, and the positive fluid passes from the conductor whose potential is highest to the other. On the other hand, a conductor placed in the neighbourhood of a body positively electrified takes a positive potential. If the latter is connected to an electrometer whose potential has been brought to zero by a momentary communication with the earth, it loses a part of its positive fluid, which passes into the electrometer, and imparts to it a positive potential evinced by the separation of the movable leaves. This is the case of M. Volpicelli's second experiment.

Inconvenience Resulting from the Use of Vessels of Bohemian Glass in Chemical Analysis, and especially in Alkalimetry.—M. P. Truchot.—It is known that glass vessels in which various liquids, and even pure water, are boiled, give up by degrees a small quantity of their substance, silica, potash, soda, and lime. Lavoisier mentioned this reaction in showing that water is not

changed into earth by ebullition. In general, the error thus occasioned may be neglected; but this is not the case in alkalimetry, and in the use of boiling-flasks and beakers of Bohemian glass, now commonly employed on account of the ease with which they bear the application of heat. If it is required, for instance, to determine an alkaline carbonate in a liquid, we run into it drop by drop a standard acid until tincture of litmus added turns reddish, and to eliminate the carbonic acid which gives a vinous red to the litmus it is raised to a boil. Vessels of Bohemian glass, otherwise well adapted for this operation, after boiling for a few minutes only, give off alkali enough to restore the blue colour of litmus after saturation. The analysis is the more erroneous the longer the boiling is kept up. This, at least, is what results from the use of glasses brought from Germany, and sold at Nancy in 1873 and 1874. This fact may be shown by boiling in a flask pure water mixed with tincture of red cabbage or syrup of violets slightly reddened by an acid. After boiling for a few minutes the liquid turns green. French glasses, with a base of soda, are not sensibly attacked, and therefore do not offer this inconvenience.

Action of Hydrogen upon Nitrate of Silver.—M. N. Beketoff.—The author concludes from a prolonged series of experiments that pure hydrogen reduces silver, like other metals, from neutral or faintly acid solutions. The negative results of M. Pellet may be explained either from the brief duration of his experiments, or from the too great acidity of his solutions.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 13, September 15, 1874.

On Maltose.—E. Schulze.—The author's experiments confirm the results of O'Sullivan's experiments, according to which maltose differs from grape-sugar, having the formula $C_{12}H_{22}O_{11}$; reducing Fehling's liquid in a smaller proportion than grape-sugar, 65 to 66 parts of which reduce as much suboxide of copper as 100 parts of maltose; and having a much greater rotatory power ($\alpha = 149.5^\circ$ to 150.6°).

Formation of Asparagic Acid in the Pancreatic Digestion.—S. Radziejewski and E. Salkowski.—The authors find the formation of this acid fully demonstrated.

Electrolysis of Potassium - Phenylacetate.—T. Slawik.—An examination of the electrolysis of the neutral phenylacetate of potash, of the same salt in alkaline solution, of free aceto-phenylic acid, the oxidation of aceto-phenylic acid in an alkaline solution by means of permanganate of potash, and the action of ozone upon aceto-phenylic acid in an alkaline solution.

Oxidation of Ortho-Toluylic Acid to Phthalic Acid.—W. Weith.—The oxidation was effected by means of a mixture of permanganate of potash and hydrate of soda. The yield of phthalic acid was from 85 to 90 per cent of the ortho-toluylic acid employed.

Structure of the Derivatives of Benzol.—E. Wroblevski.

Decomposition of Certain Diazo Compounds by Water.—E. Wroblevski.—Hypothetical papers.

Remarks on the Investigation of Hübner and Griess.—E. Wroblevski.—The author controverts the statement of Hübner and Griess that when a sulpho group is introduced into meta-brom-toluol one acid only is formed.

A Communication.—Rörsch and Fassbender.—The authors point out that a body resembling the alkaloids in its general behaviour with reagents may be developed from the liver in chemico-legal investigations. An experiment made with the recent liver of an ox yielded a body which, both in acid and alkaline solutions, was taken up by ether, and behaved like an alkaloid. Prof. Gunning, in investigating a case of poisoning by "liver-sausage" at Middleburg, obtained a similar body from a healthy boiled liver.

Great care is therefore requisite in the application of the Stass-Otto method in toxicological examinations.

Simple Preparation of the Colouring Matter of Urine from Hæmatin.—F. Hoppe-Seyler.—Jaffe's urobilin, or Maly's hydro-bilirubin, are identical with a pigment which the author previously obtained by treating an alcoholic solution of hæmatin with a reducing mixture of tin and hydrochloric acid.

Remarks on M. Traube's Communication on the "Behaviour of Alcohol-Yeast in Media free from Oxygen Gas."—Oscar Brefeld.—In a paper read before the Chemical Society at Berlin, June 22, Traube maintains that—“(1) Germs of yeast do not develop themselves in the absence of free oxygen, even in the most favourable media. (2) On the other hand, developed yeast, as Pasteur declares, can increase in suitable media, even in the absence of every trace of free oxygen.” On this Brefeld remarks—As yeast germs and developed yeast are one and the same thing, namely, simple yeast cells; as, further, between “development” and “increase” there is no primary physiological distinction, it follows that in his second proposition Traube contradicts what he has laid down in his first.

Aromatic Phosphorus Compounds.—A. Michaelis and C. Mathias.—An examination of phospho-phenylic acid and its derivatives.

Constitution of Sulphurous Ethylic Ether.—A. Michaelis and G. Wagner.—A hypothetical paper.

Constitution of "Chamber Crystals."—A. Michaelis and O. Schumann.—The authors remark that chamber crystals are generally regarded as the nitro compound of sulphuric acid, although this view is not based upon direct experiment. They find that chamber crystals, more correctly known as nitro-sulphonic acid, are mainly decomposed by perchloride of phosphorus in a manner accordant with this view, yielding the corresponding chloro-sulphonic acid.

Compounds of the Urethans with Aldehyds.—C. Bischoff.—The compounds examined are those of cinnamic aldehyd and ethyl-urethan; salicylic acid and urethan; furfurol and urethan; aldehyd and propyl-urethan; oil of bitter almonds and propyl-urethan; and valeral and xanthogenamid.

Improved Apparatus for Fractional Distillation.—J. A. Le Bel and A. Henninger.—Not intelligible without the accompanying illustration.

Remarks on Armstrong and Prevost's Communication on the Behaviour of Nitrophenol Melting at 45° with Bromine and Chlorine.—H. Hübner.—The author considers that Messrs. Armstrong and Prevost have obtained in their experiments a mixture of ortho- and para-brom-phenol.

Certain Derivatives of Phenanthren.—E. Ostermayer. The compounds examined are bromised phenanthren-chinon; dibrom-diphenic acid, $C_{14}H_8Br_2O_4$; and diphenic ethyl-ether.

On Acenaphthylen.—M. Blumenthal.—The author has examined acenaphthylen-bromide and its derivatives.

Preparation of Stilben and Certain of its Compounds.—F. C. Lorenz.—Large quantities of stilben were passed slowly—one drop in ten seconds—over oxide of lead at a dark red-heat in an iron tube. The distillate was partly solid, partly liquid. The former portion consisted chiefly of stilben. The latter portion was stilben along with other hydrocarbons dissolved in unchanged toluol. On distilling off the toluol there remained a semi-solid body, which, when united to the solid distillate, amounted to 18 per cent of the toluol employed. It was obtained perfectly pure by re-crystallisation from alcohol. The accompanying hydrocarbons were diphenyl, phenanthren, anthracen, and certain liquid bodies. Benzyl-toluol and naphthalin were not detected.

Colouring Matters obtained from Aromatic Oxy Compounds and Nitrous Acid.—C. Liebermann.—(*Phenol Colouring Matter.*) 5 grms. of phenol were mixed with an equal volume of concentrated sulphuric acid and well cooled, to prevent the formation of phenol-para-sulphuric acid. The amount of the reagent required (sulphuric acid mixed with 5 per cent nitrite of potash) was 20 grms. This was added, with agitation, in such portions that the temperature rose permanently to 40° to 50° without becoming higher. The solution was at first brown, then a fine blue. The operation, with the quantities indicated, lasted fifteen minutes. At last there was a faint disengagement of gas. On cooling, the solution was poured with constant stirring into a large amount of cold water, filtered, concentrated in a porcelain vessel, and dried in the exsiccator. The substance thus treated can be dried at 130° without undergoing any change. It is a brown powder, readily soluble in alcohol. In alkalis it dissolves with a royal-blue colour. Its composition is $C_{18}H_{15}NO_3$. (*Orcin Colour.*)—10 grms. orcin, 10 grms. sulphuric acid, 40 grms. of the reagent. The solution must become a fine purple red. When poured into an excess of water it yields a pure orange-red precipitate. The alkaline solution is purple with scarlet fluorescence. After washing for several days it is dissolved in alcohol, filtered, and evaporated. It forms a splendid cantharides-like mass. Other colouring matters are obtained at the same time, varying in solubility. (*Thymol Colour.*)—10 grms. thymol in fine powder, 10 grms. sulphuric acid, 40 grms. of the reagent. In this case the reagent must be added immediately after the mixture with sulphuric acid. The solution is first green, and then blue; the disengagement of gas must be avoided. The double volume of sulphuric acid is then added, and the whole allowed to stand for some hours. It is then precipitated by being poured into an excess of water, filtered, and washed perfectly. A violet resinous mass, soluble in alcohol, with a fine violet-red colour.

Xylindein.—C. Liebermann.—Xylindein is a green colouring matter developed from decaying oak, beech, and birch-wood under the pathological influence of *Peziza æruginea*. It contains—

Carbon	65.48	per cent.
Hydrogen	4.71	„
Nitrogen	1.00	„

Action of Hydriodic Acid upon Santonic Acid, and on Meta-Santonin.—S. Cannizzaro and Amato.—Meta-santonin is formed from santonic acid by the elimination of water. It is not formed in the period of the first action of hydriodic acid and phosphorus upon santonic acid, but after the lapse of several days.

New Formation of Phthalic Acid.—W. Weith and R. Bindschedler.—In preparing anthrachinon-sulphuric acid, a large quantity of a body was obtained, which sublimed in large colourless needles, and dissolved in boiling water, from which it separated out in shining scales. It proved to be phthalic acid.

Nitrile and Amide of "Hydroxyl-Caprylic Acid," and the Amide of Amido-Caprylic Acid.—E. Erlenmayer and O. Sigel.—The nitrile in question is a colourless oily fluid of peculiar odour, which floats upon water, and dissolves in it very sparingly. It is readily soluble in alcohol and ether. With fuming hydrochloric acid it forms a clear liquid, which, on cooling, congeals to a paste of white, silky, crystalline leaflets. This is the amide.

True Leucic Acid Nitrile, and on the Leucic Acid therein Contained.—E. Erlenmayer and O. Sigel.—The true nitrile, differing essentially from that described by Bopp, is a colourless oil, which floats upon water without dissolving. With ether and alcohol it is miscible in every proportion. At the heat of the water-bath it suffers no change, but at higher temperatures it splits up into hydrocyanic acid and amylic aldehyd.

Relative Constitution of the Diazo Compounds.—E. Erlenmayer.—A hypothetical paper.

Acrolein Bibromide.—Louis Henry.—The polymerised acrolein bibromide, $[(C_3H_4O)Br_2]^n$, contains 74.04 and 73.70 per cent of bromine, whilst bibromo-propionic acid contains 68.96 per cent.

Certain Japanese Alloys.—S. Kalischer.—

	I.	II.
Gold	4.16	0.12
Silver	0.08	48.93
Copper	95.77	51.10
	100.01	100.15
	III.	IV.
Tin	4.38	4.36
Lead	11.88	12.29
Copper	76.60	76.53
Zinc	6.53	6.58
Iron	0.47	0.33
	99.86	100.09

No. I. is light red; No. II. grey, bordering on silver-white, with a yellowish tint; Nos. III. and IV. resemble brass.

Investigations on the Volume-Constitution of Solid Bodies.—H. Schröder.—The author examines the isosterism of the anhydrous sulphates of magnesia, zinc, and copper with anhydrite; that of the corresponding sulphates and seleniates of magnesia, zinc, copper, cobalt, and iron; the isosterism of several anhydrous double potassio-sulphates of the magnesian metals; the equality of the volume-measure of the magnesian anhydrous carbonates and sulphates, and of the anhydrous double potassio-sulphates with sulphate of potash, and the rhombic carbonates and sulphates.

Fluoboracic Acid and its Salts.—A. Basarow.—The author concludes that this acid and its salts do not exist.

Preparation and Properties of Triphenyl-Benzol.—C. Engler and H. E. Berthold.—Triphenyl-benzol is sparingly soluble in aqueous alcohol, more readily in absolute alcohol, ether, sulphide of carbon, and most easily in benzol. It fuses between 169° and 170°.

Certain Derivatives of Aceto-Phenon-Alcohol and other Keton Alcohols.—C. Engler and H. Bethge.—The derivatives examined are brom-ethyl-benzol, chlor-ethyl-benzol, diphenyl-dimethyl-ethan, mono-chlor-butyl-benzol, and diphenyl-mono-chlor-methan.

Methyl-Hexyl-Carbinol.—C. Schorlemmer.—This substance when pure boils at 177° to 178°, the barometric pressure being 755 m.m.

New Chloride of Uranium.—H. E. Roscoe.—The pentachloride of uranium, UCl_5 , gave on analysis—

	I.	II.	III.
U	57.24	57.35	57.83
Cl ₅	42.43	43.01	41.93
	99.67	100.36	99.76

On Mesitylen.—A. Ladenburg.—Not adapted for abstraction.

New Formation of Ethyl-Nitrolic Acid.—V. Meyer and J. Locher.—The authors have studied the action of hydroxylamin upon dibrom-nitro-ethan.

Action of Bromallyl upon Nitrite of Silver.—R. Schiff.—The author in testing the results of Brackebusch (vii., p. 225) obtained merely negative results.

Synthesis of Aromatic Acids.—V. von Richter.—Not adapted for abstraction.

Analysis of Mineral Waters and Salts from Ciechoienck, Poland.—F. Wreden and A. Fuchs.—A detailed statement of results.

Compound of Sarkosin and Guanidin.—E. Baumann.—If sarkosin is heated with hydrochlorate of guanidin there is obtained a clear fused mass, which dissolves in hot alcohol, and forms fine tabular crystals.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of varnish. Maximilian Zingler, Buckland Crescent, Belsize Park, Middlesex. April 9, 1874.—No. 1239. This Provisional Specification describes dissolving camphor in bisulphide of carbon, mixing the solution with powdered gum copal or other hard gum, and afterwards adding either camphor or methylated spirit, or both. After the materials have been thoroughly agitated until the whole of the gum is dissolved, the process is complete, and the product is a spirit varnish. Oil varnish is produced by dissolving linseed or other drying oil in camphor, or in methylated spirits, or in a mixture of these; and this compound is mixed with the spirit varnish above described. With these spirit and oil varnishes can be mixed other gums or resins.

Improvements in galvanic batteries. Alfred Bennett, telegraph engineer, Lorrimore Road, Walworth, Surrey. April 11, 1874.—No. 1255. The novelty of this invention consists of the use of a solution of hydrate of sodium (caustic soda) or hydrate of potassium (caustic potash) with a positive electrode of zinc, using a diaphragm in which a plate of graphite is packed with pieces of broken graphite, peroxide of manganese, or a mixture of broken graphite and peroxide of manganese for the negative electrode. This is wetted with pure water, or a solution of the same salt as that used with the positive.

Improvements in manufacturing alizarin and isopurpurin out of anthracen. Gustav Auerbach and Theodor Gessert, Elberfeld, Germany. April 13, 1874.—No. 1269. According to this invention anthracen is heated with concentrated sulphuric acid to a high temperature; the product is diluted with water, and is neutralised by an alkaline carbonate or with caustic alkali. The mixture then contains the neutral sulphates of the alkaline bases employed and acid sulphates thereof. The neutral sulphates are removed by filtration or crystallisation, and the acid sulphates are neutralised by a further addition of carbonate of soda or potash. The product neutralised as described is then heated along with caustic soda or potash as long as a bluish or red colour is produced. From this product a precipitate of alizarin and isopurpurin is obtained on the addition of an acid.

Improvements in separating the metal tin from the iron in tin-plate cuttings and scraps, and in obtaining the metals, tin and iron, separate for use; also in the manufacture of sulphate of ammonia, chloride of ammonium, sulphate of iron, and sulphate of zinc. James Stuart, chemist, Church Lane, Limehouse. April 14, 1874.—No. 1276. The invention consists in subjecting tin-plate cuttings and scraps to the action of dilute sulphuric acid and atmospheric air, or to the action of dilute sulphuric acid and nitric acid, or dilute sulphuric acid and nitrous acid or hydrochloric acid, and any of the above combinations or compounds of oxygen and nitrogen, when the tin is separated from the iron and remains in solution, from which it is precipitated in the form of metal by placing in the liquor plates of zinc. The sulphates and chloride above mentioned are obtained in the process as by-products.

NOTES AND QUERIES.

Vanadium in Iron.—Can your readers inform me of a good method of detecting, and quantitatively determining, vanadium in iron and iron ores?—S. P.

Dictionary of Chemistry.—Could you kindly inform me whether there is a dictionary of chemical terms, giving the commercial and scientific names, at a reasonable price?—JAMES BAKER.

MEETINGS FOR THE WEEK.

MONDAY, Jan. 18th.—Medical, 8.

— London Institution, 5.

— Society of Arts, 8. (Cantor Lectures.) "Alcohol, its Action and its Use," by Dr. B. W. Richardson, F.R.S.

TUESDAY, 19th.—Civil Engineers, 8.

— Zoological, 8.30.

— Royal Institution, 3. E. Ray Lankester, M.A., "On the Pedigree of the Animal Kingdom."

— Society of Arts, 8. Captain Shaw, Chief Officer of the Metropolitan Fire Brigade, "On Appliances for Enabling Persons to Breathe in Dense Smoke or Poisonous Vapours."

WEDNESDAY, 20th.—Meteorological, 7. (Anniversary.)

— Society of Arts, 8. B. Waterhouse Hawkins, F.G.S., "The Graphic Method of Teaching."

THURSDAY, 21st.—Royal, 8.30.

— Royal Society Club, 6.30.

— Royal Institution, 3. Professor P. M. Duncan, "On the Grandeur Phenomena of Physical Geography."

FRIDAY, 22nd.—Royal Institution, 8. Weekly Evening Lecture. Sir John Lubbock, Bart., M.P., "Wild Flowers and Insects," 9.

— Quekett Club, 8.

— Society of Arts, 8. Indian Section; Opening Address by Sir George Campbell.

SATURDAY, 23rd.—Royal Institution, 3. Mr. E. Dannreuther, "On Beethoven; with Pianoforte Illustrations."

THE CHEMICAL NEWS.

VOL. XXXI. No. 791.

ON ATTRACTION AND REPULSION RESULTING FROM RADIATION.*

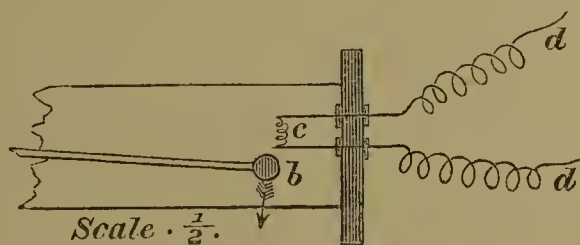
By WILLIAM CROOKES, F.R.S., &c.

(Continued from page 24.)

44. The pump was now kept at full work for an hour. The gauge did not rise perceptibly; but the metallic hammering increased in sharpness, and I could see that a bubble or two of air had been carried down. On igniting the spiral, I found that the critical point had been passed.

The sign had changed, and the action was faint but unmistakable *repulsion*. The pump was still kept going, and an observation was taken from time to time during several hours. The repulsion continued to increase. The tubes of the pump were now washed out with oil of vitriol,† and the working was continued for an hour.

FIG. 4C.



45. The action of the incandescent spiral was now found to be energetically repellent, whether it was placed above or below the brass ball (figs. 4 C, 4 D). The finger exerted a repellent action, as did also a warm glass rod, a spirit-flame, and a piece of hot copper.

46. I now heated the sulphuric acid, in the U-tube desiccator attached to the pump, until it boiled. A little aqueous vapour was driven off; the sharpness of the hammering of the mercury changed to a duller sound; and on trying an experiment once more with the ignited spiral, the action was seen to have returned to one of attraction.

On leaving the pump to itself for an hour or two, the sulphuric acid, as it cooled, again took up the aqueous vapour; and as the absorption proceeded I could trace the action of the hot spiral from attraction, through the point of neutrality, up to decided repulsion.

47. The critical point, in the case of brass balls, is much higher than with pith balls. In the case of pith, applying heat outside, I obtained neutrality when the gauge was about 7 millims. below the barometer, and decided repulsion when there was still a difference of 2 millims. With the apparatus just described, however, using brass balls and an internal source of heat, the critical point is very near the Sprengel vacuum. By close observation I can just distinguish that the gauge is a fraction of a millimetre below the barometer when the hot spiral ceases to exert an attractive action on the brass ball; but my unassisted eye is not able to detect a difference on the gauge between a Sprengel vacuum in which the ignited spiral is neutral to, and one in which it strongly repels, the brass ball.

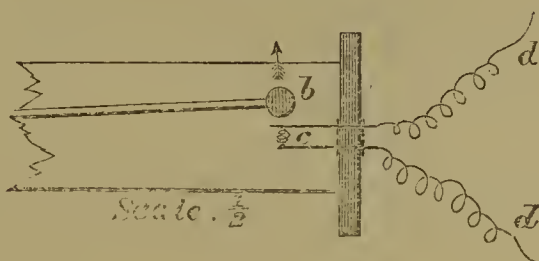
48. I have experimental grounds for believing that the position of the critical point varies with the density of the

mass on which radiation falls, with the relation of its mass to its surface, and with the temperature of the apparatus (62, 63, 64, 65, 67, 75). The temperature of the body used to attract or repel the brass or pith ball also affects the critical point, but it cannot, I think, modify it much; for with the apparatus last described no difference in kind of movement, but only in degree, was noticed, whether the spiral were ignited to full redness, or whether it were merely warmed by a momentary contact of the wires. Further experiments are in progress which may throw light on this point.

49. The very high amount of rarefaction needed before this neutral point is reached, and the change of direction of movement on applying a hot body to one arm of the balance, caused by a difference of exhaustion of a few millimetres on one side or the other of the point of neutrality, are, I think, a sufficient explanation of the anomalous results which were met with in my earlier experiments (2, 19, 20, 21, 22).

50. Although these results were sufficient to show that air-currents could not be the cause of the movements of the balance, I was anxious to decide this point once for all, by a form of experiment which, whilst it would settle the question indisputably, would be likely at the same time to afford information of much interest. Having found that the balance last experimented with had its neutral point close

FIG. 4D.



to an ordinary Sprengel vacuum, that the repulsive action only came on by still further pushing the exhaustion, and that, as I further exhausted, the repulsion got stronger, it was of interest to see what would take place in a vacuum so nearly perfect that it would not carry a current from a Ruhmkorff's coil.

In small tubes, and taking certain special precautions, I could prepare a vacuum with my Sprengel pump which would hardly allow an induction-current to traverse it, or would only show a faint, cloud-like discharge; but it was impossible to effect this in the large tubes required for these experiments, and, in fact, all the Sprengel vacuum balance-tubes which I had hitherto prepared became brightly luminous when the current from an induction-coil was passed through them. I accordingly fitted up the apparatus shown in figure 5, in which a chemical vacuum could be prepared by a method first devised by Dr. Andrews (*Philosophical Magazine*, February, 1852).

51. *a b* is the tube containing a straw beam with pith ball terminals; at *b* two platinum wires are passed through, to connect with an induction-coil; at *a* the tube is contracted to allow the apparatus to be sealed off; *c* is a portion of the tube containing a copper boat filled with freshly cast sticks of caustic potash; *d* is a tube bent as shown, and nearly full of strong sulphuric acid, which has been previously boiled for some minutes and then allowed to cool in a vacuum; *e* is a mercury joint, connecting the apparatus to the Sprengel pump. At the upper part of the tube *d* is a stopper fitting into a funnel joint and capable of being replaced (as shown in figure) by a tube through which I could pass carbonic acid when desirable. The carbonic acid was prepared by the action of hydrochloric acid on marble; when not being passed into the exhausted tube, the gas was kept bubbling through mercury, where a tube full could be collected from time to time (as shown in the figure) to test with potash. It was found necessary to keep the evolution going on all the

* From the *Philosophical Transactions of the Royal Society of London* vol. clxiv., part 2.

† This can be effected without interfering with the exhaustion. See *Philosophical Transactions*, 1873, vol. clxiii. p. 296.)

time pretty briskly, to prevent air diffusing in. The joints were made of double caoutchouc tubing, the smaller one tightly wired on and coated with glycerine before the larger tube was slipped over it. The whole was then tightly bound with wire. To prevent air creeping down between the mercury and the glass, glycerine was poured over all the mercury joints, except the one at the top of the mercury fall-tube, which was kept for oil of vitriol, with which the pump was lubricated from time to time.

52. The apparatus being exhausted of air, the balance was adjusted by heating the ends so as to slightly char the one which happened to be the lower. *f* and *g* are two collars of silver foil encircling the tube where the

the gas collected at the bottom of the mercury fall-tube of the pump was entirely absorbed by potash. When this was found to be the case, the exhaustion was allowed to proceed to the highest possible point.* The pump was then stopped; an induction-current now being passed between the wires at the end *b* showed the usual white light of a carbonic-acid vacuum (a trace of red shows atmospheric nitrogen).

The sticks of potash in the copper boat in *c* were then heated to incipient fusion, and the whole was allowed to cool for some hours. The tube was then sealed off by applying a spirit-flame to the contracted part *a*; the potash was then heated again, and the whole was set

FIG. 5.

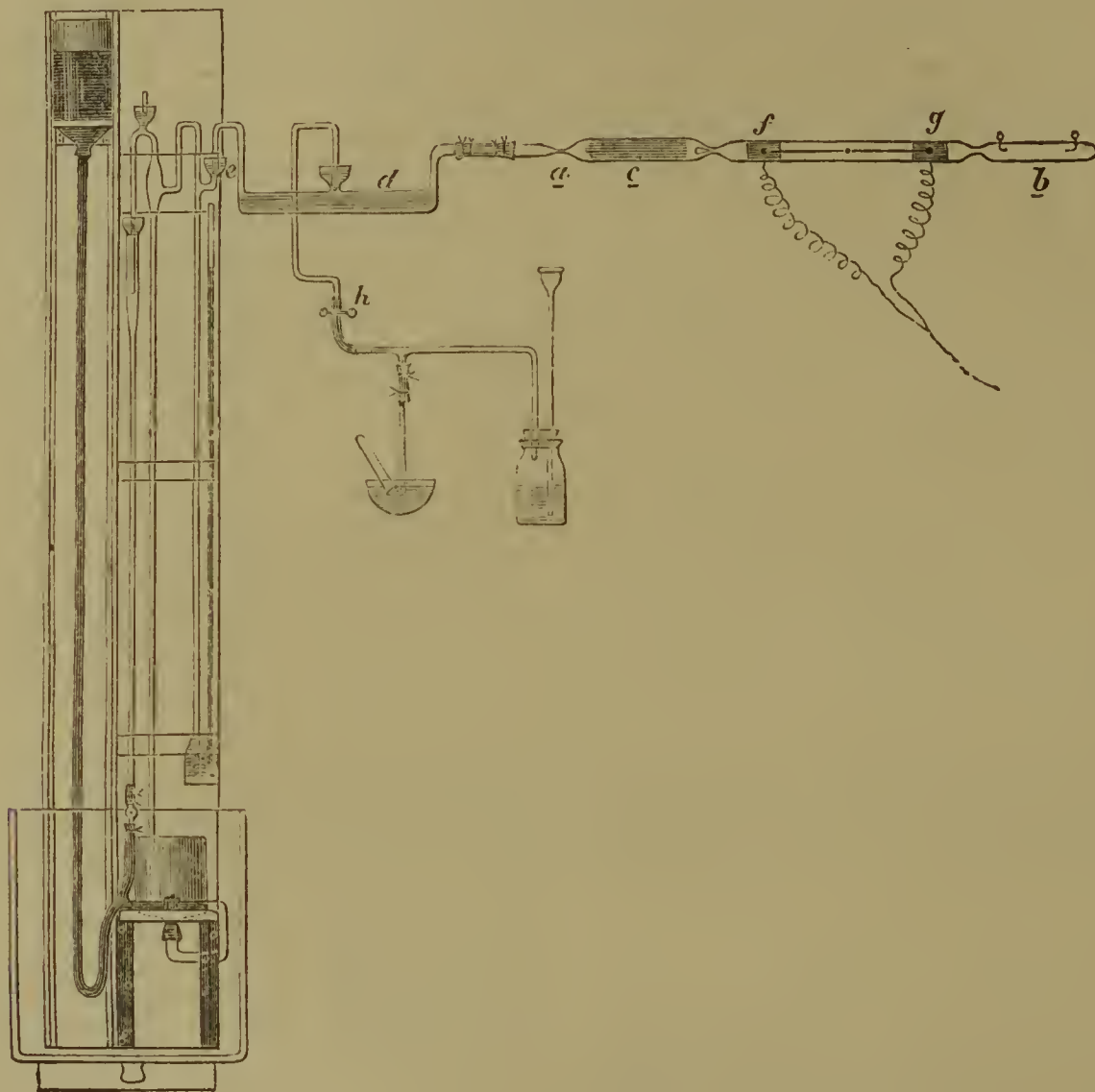
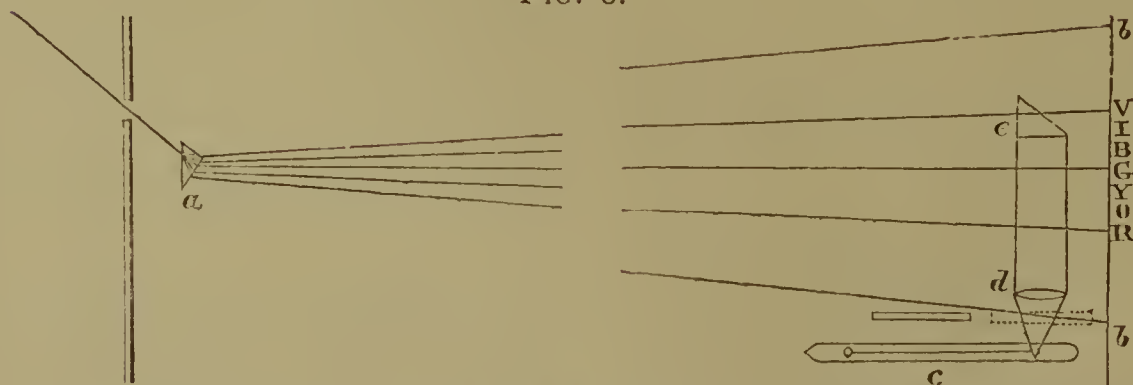


FIG. 6.



heat is to be applied, and connected with earth by wire. At a very high rarefaction the flame of a spirit-lamp excites so much electrical disturbance in the balance that its adjustment becomes well nigh impossible. This arrangement was adopted in the endeavour to carry off the electricity; it is, however, only partially successful, and the electrification of the balance at the highest rarefactions is still very troublesome.

The air having been removed from the apparatus as perfectly as the Sprengel pump would effect it, carbonic acid was let into the tube by cautiously opening the tap *h*. Exhaustion was again effected, and carbonic acid passed in a second time. This was then pumped out, and the apparatus was filled a third time. This alternate filling with carbonic acid and exhaustion was continued until

aside to give the potash time to absorb the residual carbonic acid.

53. By testing from time to time with an induction-coil, the progress of the absorption could be traced; and when the current ceased to pass through the tube, but preferred to strike across in air the full length of the spark, the vacuum was considered nearly perfect. Warming the potash with a spirit-flame, at any time, will cause it to give off sufficient aqueous vapour to allow the spark to pass as a cloud-like luminosity. This will be gradually

* When the pump is working in a very good vacuum, the friction of the falling mercury produces a very beautiful effect in the dark. Brilliant points of light flash about wherever the mercury-drops are splashed from side to side, and the pump is frequently illuminated with a phosphorescent glow filling all the tubes.

absorbed until, in the course of from a few days to a few weeks, the vacuum will again cease to conduct.

54. It is very difficult to get the vacuum in large tubes so nearly absolute as not to allow a white, cloud-like discharge to pass. I have tried experiments with balances sealed up in vacua of both kinds prepared in this manner, and I always find the repulsion on the approach of a hot body is very decided, although I do not think it is more energetic than with the same kind of balance enclosed in the best Sprengel vacuum I could prepare. These experiments have therefore set at rest the doubts which might have arisen had I only worked with the Sprengel vacua, that air-currents were the cause of the phenomena. They have decided the important point, that in a chemical vacuum which will not carry an induction-current the repulsion by radiation is decided and energetic.

55. Besides the straw and pith balance mentioned above (51, 52), I have prepared and sealed up in chemical vacua balances made of a glass beam and platinum terminals, and also of glass entirely, the ends being flat glass plates. They act in all respects as the straw and pith balance, only being somewhat less sensitive.

56. The delicacy of one of the straw and pith balances in a good vacuum is very great, as may be comprehended by the following experiment:—The balance-tube was supported on a stand, and immediately beneath one of the pith balls was placed the face of a bismuth-antimony thermopile. On connecting the terminal wires of the pile with a single cell-battery, so that the current flowed in one direction, heat was produced, and the pith ball was repelled. On reversing the current, cold was produced and the pith ball was attracted.

57. The rays of the sun allowed to shine on the terminal pith ball of one of these delicate balances *in vacuo* repel it strongly. If concentrated by a lens the focal point beats the ball away, as if it were struck with a material agent. If the sun's light be filtered through coloured glasses before concentrating them on the pith ball, the action is slightly diminished. Passing the light through two very clear plates of alum with parallel sides, and having an aggregate thickness of 8 millims., had but little action.

58. A beam of sunlight was passed through a prism *a* (fig. 6), and the spectrum was projected horizontally on to a screen (*b*) 18 feet off. In front of the screen, a little below it, was arranged the balance-tube *c*, having fixed above it a lens *d*, so that one of the pith balls was in the focus of the lens. A small right-angled prism (*e*) was then held in the different parts of the spectrum, so as to reflect any desired ray on to the lens and concentrate it on to the pith ball. By turning the right-angled prism sideways, the ray could be thrown off and on the ball, and the action readily noted. In the ultra-violet rays the repellent action was slight; the effect increased as I made the reflecting prism traverse the spectrum from the violet to the red. The maximum action was in the extreme visible red, and it gradually faded away as the invisible rays beyond the red were reflected down. An appreciable action of repulsion was, however, observed a full half spectrum in length below the least refrangible visible rays. The plates of alum, interposed in the path of the rays, cut off a small portion only of their action.

(To be continued.)

Peculiar Formation of a Compound of Ethyliden.
—F. Baumstark.—On preparing iodethylen by passing ethylen into an alcoholic solution of iodine containing iodine in excess at the temperature of 65°, a peculiar odour was perceived, like oil of mustard. If the decanted mother-liquor was mixed with water, a heavy oil of the same odour was separated. When purified it gave the formula C_4H_9IO , and distilled at 155°.—*Berichte der Deutschen.*

FLUORESCENT RELATIONS OF CHRYSENE AND PYRENE.

By Professor HENRY MORTON, PH.D.

BEING desirous of comparing the fluorescent properties of the later products of coal-tar distillation with those of the "chrysogen" already examined,* I applied to Mr. J. H. C. Cheever, superintendent of the works of Messrs. Page, Kidder, and Fletcher, at Bull's Ferry, and, thanks to his kindness, and to the liberality of the last named gentlemen, who authorised the necessary experiments, I was abundantly supplied with the requisite material.

I should fail to do justice to the scientific zeal manifested by Mr. Cheever, did I omit to relate that several explosions and one melting out of a still were encountered in the course of procuring this supply.

The substances of which I was in search were the chrysene and pyrene, which had been isolated and studied by Messrs. Græbe and Liebermann, and which are described by them in the *Annalen der Chemie und Pharmacie*, 1871, vol. lxxxi., pp. 285, 315.

They describe the material on which they worked as being that obtained by distilling coal-tar to coke, and as being, moreover, a solid of a yellow colour, showing, on fracture, large crystalline plates of a greenish fluorescence.

By treating this with cold carbon-bisulphide, a sulphur-yellow powder was left, which consisted chiefly of chrysene, the pyrene being obtained from the solution.

The material obtained by Mr. Cheever, as already related, differed so much in general character from this description that it was only the confidence that, from the mode of preparation, the pyrene and chrysene must be in it, that inspired me with courage to attempt their extraction. Thus, in the first place, the product, as deposited from the still, had the appearance of a brick-red powder, which, however, on being touched, showed itself to be pre-eminently adhesive, and by pressure, heat, or the action of solvents, settled into a thick tar, which in the property of "stickiness" would without doubt be "*facile princeps*" among all such bodies.

Once introduced into a vessel it was a fixture until removed by a solvent.

A quantity of this raw material being treated with successive portions of carbon-bisulphide, there remained on the filter upon which the residue was thrown, not a yellow powder, but a dark green and still sticky mass. This was introduced into a flask, and treated with successive portions of hot benzol, until only a black residue consisting of carbon and oxide of iron was left.

The benzol solution was filtered hot, and on cooling deposited a dirty-yellow powder.

Two more crystallisations of this from hot benzol brought it to the state of a clear lemon-yellow powder composed of minute crystalline scales, agreeing with the description of chrysene given by Græbe and Liebermann.

The extraction of the pyrene from the material taken up by the cold carbon-bisulphide was, however, a work of far greater difficulty, and its successful accomplishment is entirely due to the unwearied patience and skill of Mr. W. E. Geyer, to whom the preparation of both these substances was entrusted.

A quantity of the solution being introduced into a flask, the carbon-bisulphide was first distilled off as far as practicable on a water-bath, the last portion, however, being only removable by long exposure in a shallow dish. This was carried on in an outhouse, as the combined odour of this solvent and the tar was eminently offensive.

A portion of the resulting semi-fluid tar was then introduced into a flask of about one litre capacity, which was filled full of 95 per cent alcohol, and kept in a water-bath at about 170° F. for some hours. The alcoholic solution so obtained was then poured off and distilled for recovery of the alcohol, and the flask above mentioned was filled

up with fresh alcohol and heated as before. When this operation had been repeated twice, the alcohol of the subsequent charges was found to deposit on cooling a dirty-green crystalline substance, which was removed by filtration, and by repeated re-crystallisations from hot alcohol, was obtained as a yellow-brown power, corresponding in its properties with the pyrene of Græbe and Liebermann.

A quantity of the tarry residues from which alcohol had been distilled off, as above, was treated with picric acid, and yielded some picrate of pyrene, which was separated by long draining from much fluid tar and further purified by re-crystallisation from alcohol.

This substance, the picrate of pyrene, crystallises very readily in long dark-red needles, which are characteristic in their size and the readiness with which they form in a cooling solution.

They are readily decomposed by dilute ammonia, which combines with the picric acid, setting free the pyrene.

This substance, which was examined subsequently to the chrysene, will be more fully described after the optical properties of the other have been given.

The methods used in the study of the fluorescent and absorption-bands of these substances were exactly the same as have been already described in connection with my similar examination of anthracene, thallene, and the uranium salts (see CHEMICAL NEWS, vol. xxvi., pp. 199, 272; vol. xxviii., p. 47).

Fluorescent Spectrum of Chrysene.

The fluorescence of chrysene in its solid state, when of the bright yellow colour already described, is very strong, resembling in this respect that of chrysogen or of thallene. It is of a vivid yellow-green, and exhibits a spectrum like those of the afore-named bodies, having four blended, broad, bright bands, separated by less bright intervals. The position of these is, however, higher in the spectrum than in chrysogen or thallene, and the upper blue band found in thallene is entirely absent. This last-named point explains exactly the cause of the yellow-green colour of its general fluorescence as compared with that of thallene.

It had been already observed by Græbe that the yellow colour of chrysene was due, not to the body itself, but to some associated impurity, and though he was unable to remove this by exposure of the solution to sunlight, as in the case of anthracene, he yet succeeded in procuring a perfectly white chrysene by certain chemical processes, such as the action of a little nitric acid or chromic acid.

In view of the above, the question naturally suggested itself, whether this colouring matter might not be identical with that found in anthracene—in other words, the chrysogen—and, if not, what might be the relation between the two.

To answer this inquiry, it seemed that the only way was to repeat with care the various observations and measurements made upon chrysogen with this yellow chrysene, and then compare the results.

Both the chrysogen found in anthracene and the colouring matter present in chrysene are too small in quantity and difficult of separation to offer any prospect of a direct isolation and chemical study of these substances.

Beginning, then, with the fluorescent spectrum of chrysene, and comparing it with that of chrysogen as found in impure anthracene, we find that both give similar banded spectra, in which the bands are much blended, and are separated, not by dark, but by less bright spaces. The bands, four in number, are in colour blue-green, emerald-green, orange, and red, the division, however, between the red and orange bands being very faint.

The only difference seems to be that in the chrysene the bands are all a little further towards the violet end of the spectrum than in the chrysogen.

The following measurements will further illustrate this:—

	1st.	2nd.	3rd.	4th.
Chrysogen in anthracene	41'3	52'4	68'5	82'3
Chrysene (bright yellow)	41'7	55'0	70'5	85'5

Though this displacement, or rather difference of position, is small, it is distinct and unmistakable, and, in connection with the fact that different specimens of anthracene from different parts of the world, if equally freed from grosser impurities, show no such difference of spectra, seems to indicate a specific difference in the colouring matters, to which these fluorescences are due.

In the next place, the effects of solvents on the fluorescence of chrysene were studied and compared.

Here, as with chrysogen and thallene, it was found that the liquids which dissolved even small quantities acquired a rich fluorescence, and that when this fluorescent light was examined with the spectroscopie it showed a banded spectrum, in which the bands were displaced more or less towards the upper end of the spectrum, according to the nature of the solvent.

The following table will exhibit some of the results in this case:—

Spectra of Fluorescent Light Yielded by Solutions of Chrysene.

Bright Band.	1st.	2nd.	3rd.	4th.	5th.
Solid chrysene	41'7	55'0	70'5	85'5	—
Chrysene in chloroform	45'6(?)	56'4	72'4	92'0	112'9
„ benzol	46'4(?)	60'3	75'8	92'0	113'7
„ turpentine	47'2	62'8	78'4	95'9	116'4
„ ether	50'3	64'6	78'1	97'1	116' (?)

We should here notice that in all the solutions an upper bright band (5th) is seen, which is not found in the solid substance under equal, or even greatly increased, illumination.

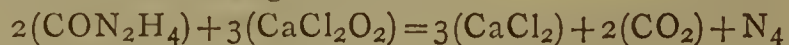
When the above measurements are compared with those made some time since on corresponding solutions of impure anthracene, a general and close correspondence is found, both as regards the general effect of the various solvents and the positions of the different lines; without direct comparison, however, it would not be safe to draw more than a general conclusion of similarity from this, as the bands are faint and less defined than in the spectra of the solid substances.

(To be continued).

ON A SIMPLE APPARATUS FOR ESTIMATING UREA.

By RICHARD APJOHN, F.C.S., Prælector of Chemistry in Gonville and Caius College, Cambridge.

A RAPID and accurate process for estimating urea is of so much importance in a medical point of view that the recent memoir of Russell and West on the subject (see *Journal of the Chemical Society*, August, 1874), has necessarily attracted much attention. The principle of the method they have employed is the same with that suggested many years ago by Davy, viz., that urea when brought into contact with hypochlorite of calcium is resolved into nitrogen, carbonic anhydride, and water in virtue of the following reaction:—



For the hypochlorite of calcium Russell and West have substituted a mixed solution of hypobromite of sodium and caustic soda, which by a like reaction yields similar products, the carbonic anhydride, however, being absorbed by the caustic alkali. Working with the latter solution, I have recently made many experiments which have conducted to the conclusion, that at a given temperature and pressure a given quantity of urea always yields the same volume of nitrogen. Operating with 0.15 grms. of urea, the barometer being at 30, and the thermometer at 60° F. the volume of the nitrogen disengaged and collected over water was found to be 55 c.c., a result almost identical with that obtained by Russell and West.

The apparatus which I have devised for the estimation of the urea is materially different from that employed by Russell and West. It is, I think, more simple, more easily worked, and will give results of at least equal

accuracy. It also possesses the advantage that the materials for its construction are to be found in every laboratory. They are:—

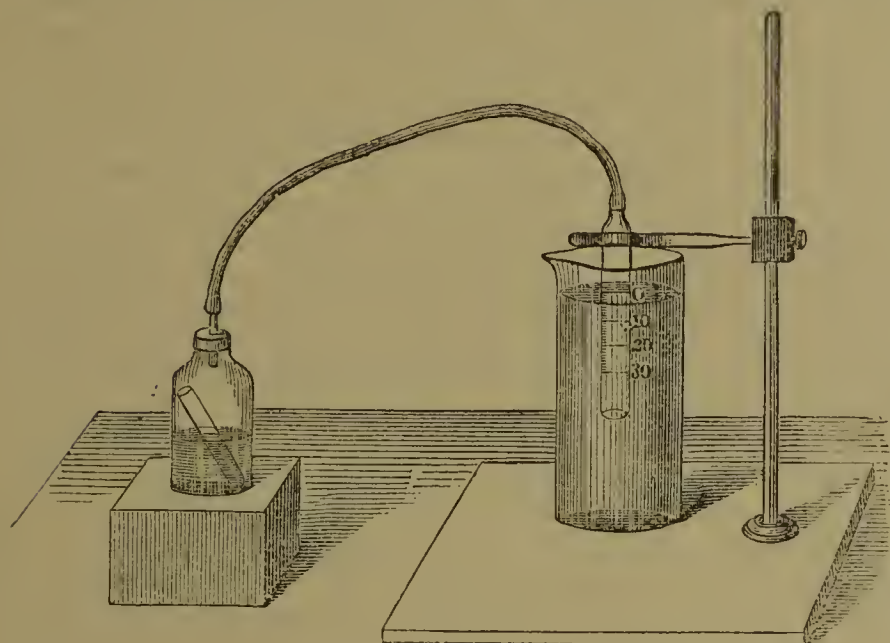
1. A glass measuring tube of about a foot in length, drawn out at the end, which will be uppermost when the tube is used, like a Mohr's burette, and subdivided into 30 parts of equal capacity, the aggregate volume of which is 55 c.c.

2. A small wide-mouthed gas bottle of about 60 c.c. capacity.

3. A short test-tube of about 10 c.c. capacity, and of such height that when introduced into the gas bottle it will stand within it in a slightly inclined position.

The following are the arrangements for combining the apparatus and working an experiment:—

The graduated tube, held in a clamp attached to a retort stand, is depressed into a glass cylinder, nearly filled with water, until the zero mark, which is near the upper end, exactly coincides with the surface of the water. 15 c.c. of the hypobromite solution (100 grms. of NaHO, 250 c.c. of water, 25 c.c. of bromine) having been poured into the flask, the test-tube containing the urine is introduced by means of a forceps, care being taken that none of its contents shall spill into the hypobromite. The flask is now closed with a very accurately fitting india-rubber stopper, perforated with a hole in which is inserted a short piece of glass tubing open at both ends, and is then connected with the measuring tube by means of a piece of elastic tubing. It is now inclined so as to allow the urine to mix with the hypobromite. Effervescence at once commences, and as it proceeds the measuring tube is gradually raised so as to relieve the disengaged nitrogen from the hydrostatic pressure. The flask is shaken a few times, and when the



reaction is completely over, the apparatus is left for a few minutes until it has acquired the temperature of the room in which the experiment is performed. Another exact levelling of the measuring tube is made, and the number of the division corresponding to the volume of the developed nitrogen is read off. Since 55 c.c. correspond to 0.15 gm. of urea, a single division corresponds to—

$$\frac{0.15}{30} = 0.005 \text{ gm. urea.}$$

Consequently, if n is the number of measures of nitrogen obtained in an experiment, $0.005 \times n$ will represent the amount of urea present. But as the quantity of urea generally experimented on is 5 c.c., if x be the percentage of urea in the urine, $\frac{x}{20}$ will be the urea in 5 c.c. Hence we have—

$$\frac{x}{20} = 0.005 \times n, \text{ and } x = 0.1 \times n.$$

It therefore follows that if we operate on 5 c.c. of urine each measure of nitrogen evolved will correspond to 0.1 per cent of urea.

The accompanying rough sketch represents the apparatus just before the flask is inclined so as to bring the urine and the hypobromite solution into contact.

The following results obtained from known quantities of pure urea will give an idea of the accuracy which is attainable by this process:—

C.c. of a 2 p.c. urea solution.	Measures of nitrogen evolved.	Weight of urea taken.	Weight of urea found.
7.4	30.0	0.148	0.150
7.2	28.0	0.144	0.140
6.0	23.8	0.120	0.119
5.0	19.5	0.100	0.097
4.4	17.0	0.088	0.085
4.0	16.0	0.080	0.080
3.0	12.0	0.060	0.060
2.0	8.0	0.040	0.040
1.0	4.0	0.020	0.020

In working with a specimen of urine, three experiments gave on each occasion 3 per cent of urea. In the case of another specimen, in two experiments the percentages of urea were 3.0 and 3.1.

By using a longer and narrower measuring tube, which would admit of finer subdivision, and by making the necessary corrections in the volume of the gas for temperature, pressure, and the tension of aqueous vapour, strictly accurate results could, I have no doubt, be obtained. It should, however, be recollected that the instrument is not intended to yield results of theoretic accuracy, and that in its present form the urea is estimated with sufficient precision for medical purposes.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, January 14th, 1875.

Professor ODLING, F.R.S., President, in the Chair.

THE visitors having been announced, and the minutes of the preceding meeting read and signed, Messrs. D. Bendix, J. A. Kendall, T. Wiltshire, F. E. Harman, and John Young were formally admitted as Fellows of the Society. The names read for the first time were those of Messrs. H. J. Yeld, H. Shephard, J. W. Thomas, A. Madge, W. Saise J. Sanders Merry, W. J. Lancaster, and C. C. Connor. There were no Fellows elected at this meeting.

The first paper, "On the Action of the Organic Acids and their Anhydrides on the Natural Alkaloids" (Part III.), by G. H. BECKETT and C. R. A. WRIGHT, D.Sc., was read by the latter. The authors find that the action of acetic anhydride on dicodeine and tetracodeine yields tetracetyl-dicodine, $C_{78}H_{80}(C_2H_3O)_4N_4O_{12}$, and octacetyl-tetracodeine, $C_{144}H_{160}(C_2H_3O)_8N_8O_{24}$. These bases are both amorphous, but the hydrochloride of the former is crystalline, whilst the basic character of the latter is very feeble. Tetramorphine yields, with acetic anhydride, a product resembling that obtained with tetracodeine. The action of acetic acid on anhydrous morphine gives rise to three isomeric diacetyl-morphines, α , β , and γ . The first and last are crystalline, and form crystalline hydrochlorides, whilst the β compound does not. The α diacetyl-morphine is formed only in very small quantity. The authors have submitted the various diacetyl, butyryl, and benzoyl derivatives of codeine and morphine which they have discovered to the action of ethyl-iodide, and find that in each case they unite with $2C_2H_5I$, forming compounds which in many instances are crystalline. The action of sodium ethylate on diacetyl-codeine does not give rise to ethylated codeine, but codeine is reproduced and more or less polymerised to tetracodeine. A similar result was obtained with tetracetyl-morphine.

The PRESIDENT, in thanking the authors, remarked that the communication opened out several points of considerable interest, such as the influence of particular substances in inducing polymerisation, and the feeble basic characters of the polymerides described, which was in accordance with the general experience that bodies of higher molecular weights exhibit less strongly marked chemical properties.

Dr. DEBUS asked the author how he knew that the amorphous β diacetyl-morphine was a distinct substance, and not either α or γ diacetyl-morphine, or a mixture of the two rendered uncrystallisable by the presence of colouring matter or other impurity?

Dr. WRIGHT replied that from the known properties of morphine six diacetyl compounds were possible, and that the name β diacetyl-morphine was applied to a certain product obtained in a certain manner. As it was not crystalline, he was, of course, unable to state positively whether it was homogeneous or not.

The next communication was a "Note on the Effect of Passing the Mixed Vapours of Carbon Bisulphide and Alcohol over Red-Hot Copper," by Mr. T. CARNELLEY. The author thought it possible that by this means normal pentane might be formed; but it was found that the products consisted of ethylene, acetylene, methane, hydrogen, and carbon oxysulphide, but that neither sulphuretted hydrogen nor sulphurous anhydride was produced. With the exception of the carbon oxysulphide, therefore, the same result was obtained as when alcohol vapour is passed through a red-hot tube.

Dr. ODLING having thanked the author in the name of the Society,

Dr. H. E. ARMSTRONG made a communication "On the Iodo-Phenols," being No. XVII. from the laboratory of the London Institution. He finds Busch's statement that iodo-nitrophenol from the non-volatile nitrophenol melts at 154° is not correct; Körner's original description of the compound is, however, accurate. The volatile nitrophenol yields not only two isomeric iodo-nitrophenols when acted on by iodine and mercuric oxide, as Busch states, but at the same time di-iodo-nitrophenol is produced, and a certain amount of the nitrophenol remains unattacked. The author has as yet only isolated Busch's α iodo-nitrophenol in the pure state; it forms orange-red prisms which melt at 109° , and not at 90° to 91° . The potassium derivative crystallises in garnet-red rhombic plates, which become of a brilliant scarlet when rendered anhydrous. According to Busch, it forms red needles. The author has also repeated his experiments on the action of bromine on β dinitrophenol. He finds that, when the latter is heated with bromine and water, he invariably obtains the bromo-dinitrophenol, melting at 116° , but on gently heating the dinitrophenol dissolved in glacial acetic acid, with excess of bromine, in one instance he obtained Körner's bromo-dinitrophenol, melting at 75.5° . In another experiment, where the mixture was heated nearly to its boiling-point for several hours, it gave the compound melting at 116° . It would seem, therefore, that the compound of lower melting-point is capable of undergoing conversion into the isomeride of higher melting-point.

The PRESIDENT said they must all have felt gratified to hear the results of Dr. Armstrong's careful work in differentiating these isomeric bodies, illustrated as it was by such beautiful specimens.

Dr. DEBUS remarked that he had felt great pleasure in seeing the great care taken in establishing the results which the author had brought before the Society. It was, perhaps, needless to say that the position assumed for the various elements in these substitution compounds was merely provisional. In the two iodo-nitrophenols obtained from the ortho-nitrophenol, the author had placed the iodine in the one case in the position 5, and in the other in the position 4, the NO_2 being 1. He thought it was not sufficiently recognised that this position was merely provisional.

Dr. ARMSTRONG replied that he quite agreed with Dr. Debus that the system was provisional, but it must be

remembered that it was an established fact that chlorine, bromine, and iodine behave similarly, at least with regard to the position these elements occupy in the compound. If it be assumed, for instance, that in the volatile nitrophenol the position of the OH and NO_2 groups is 1.2, and that in the non-volatile one it is 1.4, since methods are known by which it is possible to replace the NO_2 by Cl, and thus convert them into chlorophenols, these will likewise be 1.2 and 1.4. If we nitrate para-chlorophenol 1.4, we obtain a chloro-nitrophenol identical with that formed by chlorinating the ortho-nitrophenol 1.2; we conclude, therefore, that in the new substance the groups OH, NO_2 , and Cl occupy the positions 1, 2, 4, respectively. In a similar manner, the other derivatives may be traced out.

The meeting was finally adjourned until Thursday, the 4th of February.

NOTICES OF BOOKS.

The Origin of Creation, or the Science of Matter and Force.
By T. R. FRASER, M.D., and ANDREW DEWAR.

IN the days of our youth we read Winterl's "Prodromus to the Chemistry of the Nineteenth Century." Like the author himself, we did not perfectly understand the work, but we believe that the "chemistry of the nineteenth century" there foreshadowed must at last have made its appearance in the production of Messrs. Frazer and Dewar. We read here that "atoms are separated into two great classes, viz., mineral and vegetable atoms, or, as they may be called, hydrogen and oxygen. All atoms are male and female." This is surely Winterl's "andronie" and "thelyke" resuscitated. Further, "We find that all animals and vegetables are male and female, and as all animate matter is kept alive by eating or absorbing so-called inanimate matter, for the theory which divides atoms or matter into animate and inanimate is untenable, as we show further on, is it unreasonable to suppose that each inert atom is also either male or female? Besides, the action between the atoms, in order to form any production on earth, is (as we will also find further on) as much a marriage as the intercourse between larger masses of atoms. The mineral atom is the male; and its properties are that it is naturally cold, that it has the blue and white cold colours, and that it is acid and combustible. The vegetable atom is the female; and its properties are, that it is naturally warm, that its colours are yellow, red, and the warm colours, and that it is incombustible" (!).

We should like to know exactly what the authors mean by attributing to atoms sex and the power of reproduction? If such terms are used in the ordinary sense—and if employed in any other, they ought to be carefully explained—they imply organisation, nutrition, secretion, growth, and decay. Two animals, male and female, produce, by their union, a third being *like to themselves*, and continue to exist for a longer or shorter period after its production. Two atoms, on the contrary—say, of oxygen and hydrogen—unite to form a something, *not like, but unlike, themselves*, and become merged in it, resuming, however, their individuality on its destruction. Surely, then, no valid or profitable analogy can be shown between processes so heterogeneous.

The authors' promises to show, "further on," that the distinction between organic and inorganic beings is "untenable," and that the action between atoms is a "marriage," are not kept. We find, in place of proof, mere assertion. We have, further, to object that chemical combination takes place, not merely between those elements which our authors pronounce to be, respectively, male and female, such as oxygen and hydrogen, but also between those which they pronounce to be both males, as mercury and sulphur. It is also, to say the least, not proven that the union of atoms takes place on the dualistic principle, by continued pairing. Many phenomena lead us to believe

that a compound body may be formed by the simultaneous union of three or four elements. Again, there is the well-known fact that one element may combine with several proportions of another element, forming as many distinct compounds. These phenomena utterly overthrow any imaginary analogy between the reproduction of animals or vegetables and the formation of chemical combinations.

Minerals, we read, have the blue and white cold colours, and are acid and combustible. Let us examine these assertions. Gold, copper, sulphur, and selenium are assuredly neither blue nor white. The sulphides of cadmium, mercury, arsenic, antimony, iron, and copper exhibit those very red and yellow colours which Messrs. Fraser and Dewar pronounce to belong to the vegetable atom. Calcium, barium, potassium, sodium, silicon, and aluminium have the "cold white colour" after they have combined with the "vegetable atom," oxygen, which ought to have given them a yellowish or reddish cast. "The mineral atom" is not necessarily or usually "acid." As a rule, it is only acid after union with the "vegetable atom," oxygen, which, however, uniting with other mineral atoms, forms alkalis and alkaline earths. Perhaps the authors may take exception to what we here put forward as facts fatal to their views. It is, of course, open to them to take this ground. But, if so, they must be able to make good their ground, not by assertion, but by accurate work in the laboratory. Failing this, they cannot even expect a hearing.

On the faith of old and inaccurate experiments, they believe that "plants may be grown in sand, litharge, and even in common shot, merely by moistening them with water." Again, "by a simple experiment we can show that, if these granites or *metals* were pulverised, mixed with vegetable atoms, and seeds were planted in them and well watered, the atoms would show themselves alive by dissolving and aiding in producing a plant, and probably a flower."

We invite the authors, once for all, to try such an experiment, with the necessary precautions to exclude error. Let them sow, say, wheat, in "common lead shot," watering it with distilled water, and taking care that no other kind of matter is introduced in the form of dust or conveyed by the air. Let them finally submit the crop to analysis, and prove that there is an excess of carbon, phosphorus, sulphur, lime, magnesia, potash, &c., over and above what is present in the seed. They can point to no case where such an experiment, conscientiously performed, has proved successful.

The authors deny the presence of moisture in the atmosphere. They say, "if we lay aside a loaf of bread, it will be chemically changed in a few days, and become hard and stale, instead of soft and moist. Scientific works tell us there is moisture in the air, but all experience rather proves to us that there is none (!), for we can keep nothing moist for any length of time. Our bread becomes stale, our wood loses its sap, our gardens thirst for rain, and even our tumbler of water eventually evaporates into air in the atmosphere."

Did the authors, in all the wide and varied experience of which they have thought it necessary to inform the public, never meet with any substances which, when exposed to the air, instead of drying up, became more and more moist? Did they never meet with the case of a shirt, or of bed-linen, though carefully dried, becoming damp by mere exposure to the air? If so, they are as little versed in daily life as in the phenomena of the laboratory. "Our tumbler of water," say the authors, "evaporates into air." By this passage, they apparently mean that it becomes air, for on the previous page we read that the atmosphere is "composed of the same material as the water, only in different proportions." Now, if they are of this opinion, let them prove it correct. Let them demonstrate the presence of nitrogen in pure water, or of hydrogen in air dried and free from ammonia. If they can do this, chemists will be the first to welcome their theories. They cannot, however, speak of hydrogen and nitrogen as identical, for nitrogen is declared to be one of their female,

or vegetable elements, while hydrogen is the very type of their male, or mineral class of atoms.

What we have to protest against in this book is not merely the abundance of gross errors, but the total absence of scientific method and of the scientific spirit. Almost every page bears evidence of vague habits of thought, of inaccurate observation, and of hasty generalisation. Of what is required to establish a theory, the authors seem to have but a very dim conception. That such a book should be produced in Britain, and in the latter part of the nineteenth century, is truly humiliating.

Air as Fuel, or Petroleum and other Mineral Oils Utilised by Carburetting Air and rendering it Inflammable. By OWEN C. D. ROSS, M. Inst. C.E. London: E. and F. N. Spon.

As appears from the title of this work, the author proposes, as a substitute for coal, air rendered inflammable by means of mineral oils. He describes the experiments made by MM. Sainte-Claire Deville and Dieudonné in order to determine the value of petroleum as a source of heat, and the similar trials made at Woolwich in 1866 and 1867. From both these series of experiments it was concluded that, at then existing prices, petroleum could not compete with coal. Since that time, however, the price of petroleum once distilled has fallen from £24 per ton to £9, whilst the crude article at the wells may be had for considerably less. Vast deposits of bitumens have latterly been discovered in many parts of the world, and the probability is that an increased demand will lead to its discovery in other places.

The author lays down the following conclusions as thoroughly established:—"The intrinsic calorific power of such oils for evaporative, or steam purposes, is several times greater than that of coal; the thermal effect, or intensity, of heat obtainable from them in metallurgical operations requiring very intense heat is still more favourable, and allows the efficiency of furnaces requiring such temperatures to be many times multiplied; illuminating gas of very superior quality may be obtained from them at much less cost and with much greater convenience than from coal." Among the advantages of "carburetted air" as fuel may be enumerated its freedom from sulphur, an incalculable benefit in metallurgical operations. The use of a non-sulphurous fuel in our households would do more to purify the air of populous districts than any "smoke consumption Act" can ever effect. On board sea-going steamers, the stock of fuel would require only one-fourth of the space now taken up by coal. "Consequently there would remain available for freight-paying cargo three-fourths of the space now occupied by coal. To many owners of ocean steamers this would be equivalent to an additional net profit at the rate of from £2000 to £2500 per voyage."

Whether the author has succeeded in overcoming all the practical difficulties connected with his project, time and experience must decide; but, in drawing attention to the capabilities of petroleum, he is doing a most meritorious act. The price of coal, which still remains preposterous after the combination of circumstances which led to its rise in 1872 has passed away, is a serious evil to our manufactures, our commerce, and to our health and domestic comfort. Surely it behoves us to examine earnestly and candidly every proposal which may emancipate us from our present bondage to the coal-interests.

Selen-Cyan-Ethylen and Selen-Cyan-Methylen.—Bernhard Proskauer.—The former of these compounds has the formula $C_2H_4(CNSe)_2$. It is very stable, forms fine white needles, insoluble in cold water and ether, sparingly soluble in hot water and cold alcohol. They melt at 128°, and are decomposed to a brown liquid of an unpleasant odour.—*Berichte der Deutschen.*

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 25, December 21, 1874.

Moderated Oxidation of the Carbides of Hydrogen: Amylen.—M. Berthelot.—The constitution of organic compounds, *i.e.*, the system of more simple bodies by means of which the former may be produced, and which may in turn be reproduced therefrom, should be studied by having recourse to the most moderate reactions, the lowest temperatures, and the least violent agents. For instance, pure chromic acid should be preferred to bichromate of potash mixed with sulphuric acid, which most chemists employ in studying the constitution of the carbides of hydrogen by way of oxidation, and which they designate by the abridged, but incorrect, name of chromic acid. In fact, true chromic acid gives rise to products less remote from the oxidised body, especially if it is used cold, and in a dilute solution, under which circumstances it gives up merely the fifth part of its oxygen, and becomes chromic chromate, instead of losing the half, and passing into chrome alum. The author has already shown the efficacy of this reagent for changing camphen into camphor, ethylen into aldehyd and acetic acid, acetylen into acetic acid, allylen into oxide of allylen and propionic acid, propylen into acetone and propionic acid. He now extends his researches to amylen derived from amylic alcohol of fermentation, as well as hydride of amylen of the same origin. A mixture of acids was formed in about the following proportions:—

Valerianic acid	36
Butyric acid	16
Propionic acid	17
Acetic acid	28
Formic acid	3

In the course of his experiments he finds that propionic acid is displaced by all the others; next follows the butyric; valerianic displaces the two former, but it is in turn expelled by the acetic, and this again by the formic. These results, however, are merely approximate, as there is always some partition of the base among the acids employed. The regulated oxidation of propylen yields, as main products, propionic acid and acetone, with a little acetic, formic, and carbonic acids.

Apparatus for the Measurement of Gases in Industrial Analyses, or Gas-Hydrometer.—E. J. Mau-mène.—Manufacturers of sugar have long wished for a simple, practical, and inexpensive means of rapidly estimating the quality of lime as it comes from the kilns, that is to say, the true degree of its alkaline power at the moment when it is used in the form of milk. The author presents to the Académie a new instrument which he has contrived for this purpose, and to which he gives the name gas-hydrometer, because the gas disengaged in the analyses for which it is adapted is measured by an equal volume of water. It is not a mere calcimeter, or instrument for measuring lime, but at the same time a potassimeter, an acidimeter, &c. The same instrument will serve for the sugar manufacturer to estimate the value of the lime, that of the limestone, that of the scum from carbonating, of the cakes from the filter, that of the acids employed in washing the bone-black, that of the black itself before and after revivification. The essential portion is an india-rubber bottle, fastened by its neck to the end of a copper tube. The other extremity of this tube carries a caoutchouc tube carefully fastened to a copper tube, twice bent, which traverses a caoutchouc stopper serving to close a flask in which the reactions are produced. Suppose, for example, that it is required to assay a limestone: take six fragments at least from the heap, selecting such as appear the most

different. These pieces are broken up in an iron mortar till the largest fragments are about the size of a pea. The whole is then passed through a fine sieve. The dust which passes through is taken for analysis. 10 grms. of this are weighed on a balance sensitive to 10 milligrams. This weighed portion is passed into the flask by means of a gutta-percha funnel. The funnel is washed with the amount of water which a tube of hardened caoutchouc, contained therein, will hold. The outside of the tube is then wiped, and filled to 2 centimetres of the mouth with common hydrochloric acid, of specific gravity 1.18 or 1.20. This tube is laid hold of by introducing into it a pair of brass forceps, the two arms of which, diverging at the extremities, lodge their hooks under a ledge in the interior of the tube, and thus permit it to be easily lifted. It is let straight down into the flask, and the forceps are carefully withdrawn without spilling a drop of the acid. A copper cylinder, which encloses the caoutchouc bottle, set in an upright position, is filled with water round about the bottle. It is closed with a stopper of caoutchouc, pierced with two holes, through one of which passes the copper tube above mentioned, and through the other a tube of metal to lead away the water. The flask being then closed with its stopper, the copper cylinder is raised into a horizontal position, and the apparatus is ready for use. The flask is sloped gently to mix the acid with the 10 grms. of stone. A disengagement of carbonic acid gas immediately swells the caoutchouc bottle, and the water surrounding it being displaced flows into a graduated tube, where it is collected. The reading on this tube gives the volume of the gas.

Observations on a Recent Communication by M. A. Cornu on the Degree of Precision of Foucault's Method for Measuring the Speed of Light.—M. J. Lissajous.—A protest against a passage which throws doubt on the exactitude of Foucault's method.

Pyruvic Ureides; Synthesis of Parabanic Acid.—M. E. Grimaux.—Pyruvite is split up by hydrochloric acid into urea and pyruvic mono-ureide, and by nitric acid into nitrate of urea and nitro-pyruvic mono-ureide. This latter compound may, by indirect oxidation, be converted into oxalylurea or parabanic acid.

Molecular Equilibrium of Solutions of Chrome Alum.—M. Lecoq de Boisbaudran.—The author has announced (*Comptes Rendus*, Nov. 9, 1874, p. 1077) that blue solutions of chrome-alum, recently prepared in the cold, acquire gradually a greener shade, and that green solutions of the same alum, recently prepared in heat, gain by degrees a more blue tint; in a word, the two solutions approach slowly to an intermediate colour, which is the proof of the coexistence of the two modifications, in a stable and constant state of equilibrium, for one and the same temperature. These changes of colour are observed whether the liquids are in closed or open vessels, with or without contact of crystals, and whether concentrated or dilute. Still, the changes of colour being very slow, we cannot, by observing them, obtain an exact measure for the progress of the transformation. The author, takes therefore, advantage of the variations in volume which should accompany the change of molecular equilibrium of the salt. On the one hand, the blue alum of the solution made in the cold loses a part of its water of hydration in becoming green. On the other, the green alum of the solution made in heat gains water in becoming blue. In the former case, there ought to be dissociation with change of volume; in the second, the combination should produce a decrease of volume. These previsions are fully confirmed by experience.

Preparation of Pure Salts of Nickel from the Nickel of Commerce.—M. A. Terreil.—Noticed elsewhere.

Toxicological Detection of Cyanide of Potassium in Presence of Double Non-Poisonous Cyanides.—M. E. Jacquemin.—A description of a method for detecting cyanide of potassium accompanied by prussiates.

The author dilutes with water, filters after maceration, neutralises the filtrate with pure carbonate of soda, heats a part to ebullition with 2 or 3 grms. of hyposulphite, then, after cooling, acidulates slightly with hydrochloric acid, and adds perchloride of iron, which gives the characteristic reaction of sulphocyanides.

Action of Chlorine upon Perbromide of Acetylen.—M. E. Bourgoin.—Noticed elsewhere.

Researches on Pathological Albumens, Zymoses, Means of Determining Albumen, and the Alterability of Albumenoid Matters.—M. J. Birot.—Not adapted for abstraction.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 13, September 15, 1874.

Sarcosino-Uric Acid.—A preliminary communication.

Secondary Products from the Preparation of Benzyl-Toluol.—E. Weber and Th. Zincke.—Among these may be mentioned anthracen, and a hydrocarbon, $C_{14}H_{10}$, much more soluble than anthracen.

Further Contributions to the Knowledge of the Polythionic Acids.—W. Spring.—This paper treats of the organic hyposulphurous acids, hyposulphurous acid, trithionic acid, the synthesis and splitting-up of the polythionic acids, and of organic poly-thionic acids.

Action of Perchloride of Phosphorus upon Ethylen-Disulphonic Acid.—W. Königs.—The compounds successively formed are $C_2H_4 \cdot 2(SO_3H)$, $C_2H_4 \cdot 2(SO_2Cl)$, C_2H_4Cl , SO_2Cl , $C_2H_4 \cdot 2Cl$.

Thio-Benzol and Thio-Aniline.—The author has prepared several substitution-products of thio-benzol, taking his point of departure both from phenyl-sulphide and from thio-aniline.

Contributions to the Knowledge of Ethyl-Phenol and Ethyl-Benzol Sulphonic Acids.—P. Chrustchoff.—Solid ethyl-phenol was heated with anhydrous phosphoric acid. Ethylen slowly escapes, and could be converted into bromide of ethylen by absorption in bromine. From the residue a phenol was separated by decomposition with hydrate of potash, which had the boiling-point of common phenol. On account of the smallness of the quantity, it could not be obtained in a state of purity, but with bromine-water it yielded the characteristic tribromphenol; and when boiled with nitric acid of sp. gr. 1.4 it yielded picric acid in abundance; whilst ethyl-phenol, under the same circumstances, yields only oxalic acid.

Mixed Sulphones.—P. Chrustchoff.—A preliminary communication on the synthesis of mixed sulphones.

Contributions to the Knowledge of Mesitylic Oxide and of Phoron.—L. Claisen.—From the author's experiments, the view that mesitylic oxide and phoron are intermediate products in the formation of mesitylen appears untenable.

Two Pathological Colouring Matters in Urine.—F. Baumstark.—The author has obtained two peculiar well-characterised pigments from the urine of a patient suffering from *lepra*. They are the more interesting from their evident relation to hæmatin. Urorubro-hæmatin, $C_{68}H_{94}Fe_2O_{26}$, or hæmatin in which 8H are replaced by $4C + 16H_2O$. It is a blue-black, very light mass, with a nut-brown streak, insoluble in water, alcohol, ether, chloroform, and solutions of common salt. Soluble in alkalies and ammonia with a brown-red colour, which takes a very fine garnet-red on dilution, without dichroism. Acids do not give a precipitate, but change the colour to a bluish red. It dissolves in alkaline phosphates and carbonates with a fine magenta shade, and in acidulated alcohol and dilute sulphuric acid with a violet. The spectrum, both of the acid and alkaline solutions, shows little absorption of the violet and blue. In the acid solution there is a narrow band before D and a broad one behind D, closer to each other than in oxyhæmoglobin.

On dilution, the narrow band disappears first. In the alkaline solution there is a band to the right of D, one by E, a broad one to the right of F, and one to the right of G, without the blue between the latter being absorbed. All four disappear equally on dilution. *Urofuscohæmatin*, $C_{68}H_{106}N_8O_{26}$, or a hæmatin in which the iron is replaced by hydrogen. Black, pitchy, shining mass insoluble in water, alcohol, ether, chloroform, acids, solutions of common salt, with or without the addition of hydrochloric acid. It dissolves in alkalies, ammonia, alkaline phosphates and carbonates with a brown colour. Its optical behaviour is not characteristic.

Contributions to the Decision of the Question of Position in the Aromatic Group.—R. Fittig and E. Mayer.—Not suitable for abstraction.

Investigations on the Synthetic Formation of Aromatic Compounds by Dehydration.—This interesting series, which is unfortunately too extensive for our columns, consists of a paper by Othmar Zeidler on the compounds of chloral with brom- and chlor-benzol; one by Julius Weiler on the action of methylal upon toluol, benzylchloride, and diphenyl; aldehyd and benzol, by Adolf Baeyer; action of chloral and aldehyd upon toluol, by Otto Fisher; on a compound of chloral with thymol, by Emil Jäger; on the compounds of phenol with the aldehyds, by Edm. ter Meer; synthesis of triphenyl-methan and methylphenyl-diphenyl-methan, by W. Hemilian; and on fluorescein, and the phthalein of orcin, by E. Fischer.

Occurrence and Composition of Acids in Crude Petroleum.—Carl Hell and Emil Medinger.—A preliminary communication on the presence of acids in Wal-lachian petroleum.

Action of Nitro-Sulphuric Acid upon Ortho-Nitro-Benzoic Acid.—P. Griess.—In this reaction there are formed four distinct acids, the styphnic acid, and three isomeric dinitro-benzoic acids, two of which are new.

On Iso-Cyan-Phenyl-Chloride.—E. Sell and G. Zierold.—This substance has the formula $C_7H_5NCl_2$. The authors have examined its behaviour with glacial acetic acid, oxide of silver, sulphuretted hydrogen, aniline, water, and alcohol.

Certain Nitro Derivatives of Sulpho-Carbanilid.—A. Brückner.—The author has examined dinitro-carbanilid, dinitro-sulph-urea, and the corresponding mono-nitro substitution-product obtained by heating phenyl-mustard oil with nitranilin.

Action of Sulphuric Acid upon Substituted Anilines.—G. A. Smyth.—The substances examined are the mono-sulph-acid of dimethyl-aniline, that of mono-methyl-aniline, that of mono-ethyl-aniline, and of diethyl-aniline.

Action of Aniline upon the Fulminates.—A. Steiner.—Aniline has a profound effect upon the fulminate of mercury. Metallic mercury is liberated, and there remains a body of the formula $C_7H_8N_2O_2$.

Certain New Nitro-Diphenylamins.—P. Townsend Austen.—An examination of para-pikryl-meta-nitranilin, para-pikryl-para-nitranilin, para-pikryl-meta-pikrylamin, di-para-pikrylamin, para-dinitro-phenyl-meta-nitranilin, para-dinitro-phenyl-para-nitranilin, and barium-di-para-pikryl-diamin.

Behaviour of Methylen-Iodide with Certain Amines.—J. Lermontoff.—The author has examined the action of ethylamin, tri-ethylamin, and aniline upon methylen-iodide.

Phenylen-Oxaminic Acid.—O. Klusemann.—This acid is composed of—

Carbon	53.34
Hydrogen	4.44
Nitrogen	15.56
Oxygen	26.66

100.00

which agrees with the formula $C_8H_8N_2O_3$.

Certain Derivatives of α -Phenylene-Diamin.—G. A. Barbaglia.—Not suitable for abstraction.

Certain Derivatives of Toluylen-Diamin.—R. Lussy.—This paper treats of toluylen-urethan and toluylen-sulphurea.

Preparation of a Dinitrated Benzanilid, and its Behaviour with Reducing Agents.—M. Mac Hugh.—The author sought to produce a dinitro-benzanilid which should contain a nitro group, both in the benzoyl residue and in the phenyl group.

On Nitro-Cresol.—Paul Wagner.—The author treats of amido-cresol, diazo-cresol, and nitro-cresolic ether.

On Selenbenzamid.—F. von Duchand.—A preliminary communication.

Aromatic Sulphines.—Cæsar Schöller.—The author sought, first, to form dibenzyl-methyl-sulphin-iodide by the action of methyl-iodide upon benzyl-sulphide. The result was a mixture of benzyl-dimethyl-sulphin-iodide and trimethyl-sulphin-iodide. If 2 parts of iodide of methyl and 3 of benzyl-sulphide are boiled, and allowed to stand for two days, there is obtained a reddish brown oily mass, which deposits fine crystals on the sides and bottom. The two sulphines contained may be separated by the fractional precipitation of their chlorides with chloride of platinum.

Certain New Organic Selenium Compounds.—C. Loring Jackson.—The author has obtained dibenzyl-selenide, $(C_7H_7)_2Se_2$; benzyl-selenious acid, C_7H_7SeO, HO ; and trimethyl-selenin.

On Sulpho-Cyan-Methylen.—J. Lermontoff.—Two molecules of sulphocyanide of potassium were brought in contact with 1 molecule of methylen-iodide in alcoholic solution, and digested for two to three hours in the water-bath with an upright condenser. The crystals obtained have the composition $C_3H_2N_2S_2$.

Action of Bromine on Acetate of Methyl.—A. Steiner.—The result appears to be hexa- rather than penta-bromacetone.

On Malonic Acid.—C. Osterland.—The author examines methylo-malonic ether, $C_5H_8O_4$; and malonamid, $C_3H_6N_2O_2$.

Certain Derivatives of the Secondary Butylic Alcohol.—S. Reymann.—Not suitable for abstraction.

Colouring Matter Analogous to Magdala Red.—M. T. Lecco.—Reserved for insertion in full.

Ethereal Oil of *Lepidium sativum*.—A. W. Hofmann.—The oil of *Lepidium* is identical with that of *Tropæolum*, both being the nitrile of phenyl-acetic acid. The former oil boils at 226.5° (corrected 231.5°), the latter at 226° (corrected, at 231.9°).

Reimann's *Farber Zeitung*, No. 46, 1874.

This number contains fast dyes for knitting-yarns; a black printing colour for woollen goods, which is prepared as follows:—

Extract of logwood at 10° B.	..	1.0	litre.
Black liquor at 10° B.	.. .. .	0.2	„
Potato starch	130	grms.	
Calcined starch	200	„	
Blue vitriol	30	„	
Protochloride of iron at 10° B.	.. 30	„	
Extract of indigo	70	„	
Nitrate of iron	70	c.c.	

There are receipts for a catechu-brown on cotton; for a soap-proof top-blue on vatted cottons and linens; and a fine rose on mixed piece goods and rags.

Preparation of Anthrachinon, $C_{28}H_{18}O_4$.—The conversion of anthracen into anthrachinon is generally effected by means of bichromate of potash and sulphuric acid. Some manufacturers add a little nitric acid towards the end of the reaction. The anthracen and the bichromate are intimately mixed, and the sulphuric acid, diluted, is added by degrees. On the large scale the operation is

performed in vats lined with lead, in which steam is passed. The addition of acetic acid is an improvement. When it is used the proportion of sulphuric acid must be modified. On the small scale the following proportions are recommended:—1 part anthracen is mixed with $2\frac{1}{2}$ parts of bichromate of potash, 4 parts of pyroligneous acid are added, and after heating a time 6 parts of sulphuric acid, previously diluted with double its volume of water, are gradually added. The mixture is heated in the water-bath till the reaction is at an end. The yield is almost equal to what theory requires.

The anthrachinon generally requires to be purified. This is effected by dissolving the crude product in sulphuric acid in cast-iron vessels, and heating until the evolution of sulphurous acid ceases. It is then precipitated with excess of water, collected, well washed, pressed, and dried in a stove at 50° . It is then a greenish-grey impalpable powder.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the furnaces used in the manufacture of alkali and other products. Isaac Shimwell McDougall, of the firm of McDougall Brothers, manufacturing chemists, Manchester and London. April 16, 1874.—No. 1311. This invention is for applying the fuel or heat necessary for the manufacture of alkali, and for the roasting of salt-cake, nitre-cake, sulphate of potash, and other products; and for the finishing of soda-ash immediately under the bed of the furnace, and then through or over the surface of the latter, a method hitherto impracticable except by the gas process, owing to the rapid destruction of the said furnace bed. It consists in forming the fireplace in a chamber situate at one end of the brickwork containing the furnace, the length of the fireplace being crosswise to the breadth of the said furnace. The fire-bars are placed deep enough in this chamber to allow of sufficient room above the same for air to mix freely with the gases of the fuel before passing onward. Extending longitudinally from the upper side portion of the fireplace chamber, and backwards therefrom immediately underneath the furnace, is a flue inclining upwards to the end of the furnace, and divided transversely into a number of smaller upright flues by substantial division-walls, which are built the full length of the furnace bed. The crown of the fireplace chamber is formed of a strong double-ringed brick arch, over which is laid a tile 3 inches thick, forming a portion of the furnace bed. This arch spans from the outside walls of the fireplace chamber (or those walls in proximity to the flues of the decomposing pot) to the top ends of the said division walls, connecting which, to a distance of about 4 feet back from the fireplace chamber, is a series of small one-brick arches. Over these arches are laid tiles 3 inches thick, forming another portion of the furnace bed, the remaining portion of the latter being formed by placing along its entire length a double layer of 3-inch tiles covering the upright spaces or flues between the said division-walls. At the back end of, and resting transversely on, the furnace bed is a bridge wall to prevent the contents of the furnace falling into the flues and fire underneath. The gases formed in the fireplace chamber pass thence through the smaller longitudinal upright flues over the end of the furnace bed and over the bridge wall thereon, through or over the body of the furnace, and coming in contact with the materials therein, are then conveyed by a suitable flue or flues to the condensing towers or chimney in the usual manner.

Improvements in the treatment of wool, hair, feathers, and other similar animal matters, in order to obtain size and other useful products therefrom. Alfred Smith, of Manchester, Lancaster. (Partly a communication from D. Melville, of Christiania, Norway.) April 16, 1874.—No. 1314. In this invention wool, hair, feathers, or fabrics containing such animal matters, are subjected to the combined action of heat, water, and pressure, in a closed kier, until the animal matter is dissolved. Dyes and oil may be recovered from the solution. The solution may be used as a size or as a manure.

Improvements in the construction of self-igniting and inextinguishable danger signal lights for marine and other purposes. Nathaniel John Holmes, of The Hall, Primrose Hill Road, Regent's Park, London, Middlesex. April 17, 1874.—No. 1324. These improvements relate to an improved mode of constructing life buoy or danger signal lights when phosphuretted hydrogen gas or phosphuret of calcium is employed. In one of these improvements I make use of a compound chamber, one chamber being for the reception of the phosphuret of calcium, the other chamber as an air chamber to give buoyancy to the rescue signal when placed in water. The openings at the top and bottom of the rescue signal for the emission of the flame and ingress of the water are closed by metal strips soldered on, which can be removed by tension when the signal is required for use; or in place of the strips, metallic capsules may be employed through which a plug or button is drawn by tension to form the necessary orifices for the flame and water when the rescue signal is required for use. In another improvement I employ a compound chamber, each chamber being fitted with the necessary parts to produce the light. This compound rescue light is employed when great power of flame is required. In another improvement the rescue signal light is constructed so as to be fired as a shell from a mortar or bomb, either with or without attachment to the rocket line apparatus.

THE CHEMICAL NEWS.

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ON ATTRACTION AND REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

(Continued from page 35.)

59. THE following experiments were tried with a very sensitive pith-ball balance sealed up in a good Sprengel vacuum:—

The beam was turned over, so that the centre of gravity was a very little above the centre of suspension; the balance consequently set on either side. In this condition the ball touching the tube could be made to rise by placing the finger beneath it, the balance then oversetting on the other side. The higher ball could also be made to sink in the same manner by placing the finger on the top of the tube just over it.

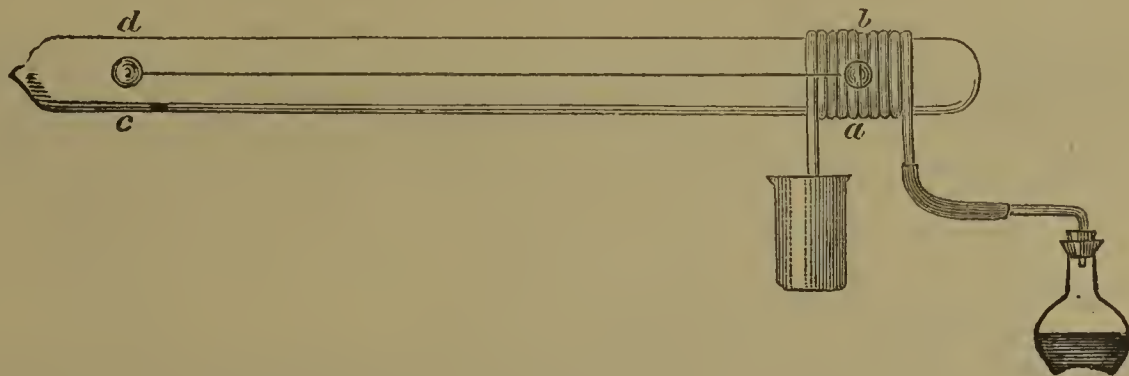
other plain, were fixed to the ends of a straw beam; they appeared equally sensitive to radiation.

Two rectangular blocks of silver and bismuth, each weighing $4\frac{1}{2}$ grains, were balanced against one another on a straw beam;* they were each repelled by a warm body applied above or below. The bismuth was a little more sensitive than the silver to the action of heat, but it exposed a little more surface for the rays to impinge upon.

64. A selenium ball was balanced against a copper ball; the selenium was more sensitive to radiation than the copper; but I do not think it was more so than would be due to its more extended surface. When I allowed luminous rays, either from the sun or from artificial sources of light, to fall on the selenium, I could detect no special action which I could correlate with the action of light on selenium lately discovered by Mr. Willoughby Smith.†

65. Two pieces of thin mica, each having a surface of half a square centimetre, were fastened to the end of a straw beam, one being horizontal and the other vertical. On applying slight warmth, each end was found to be very sensitive. The horizontal mica was easiest affected by the heat; but it had not that great advantage over the vertical piece which might have been expected from the much greater surface exposed had the movement been due to air-currents.

FIG. 7.



60. A piece of glass tube, bent in the form of a spiral (fig. 7), was supported on a stand, so that it could be slipped over one end of the balance tube, which it fitted loosely. Steam was then passed through the glass coil, and a woollen cover was put on it, so that the end of the balance-tube could be kept at 100°C . When the temperature became uniform and steady the pith ball took up a position, as nearly as could be judged, in the axis of the spiral, and then remained stationary. On raising the hot coil, so as to bring the lower part close to the tube, the pith ball rose a little, and on lowering the spiral the pith ball sank.

On applying the warm finger to the cool extremity of the balance-tube, either above or below the pith ball, the latter was repelled by it; and by employing a lump of ice in the same way in each position the pith ball was attracted. The balance seemed to be as sensitive when one end was heated in this manner as it was when both ends were of the same temperature; but the rise and fall were not to so great an extent, owing to the controlling action of the hot spiral.

61. The following experiments were tried with a view of ascertaining the conditions of greatest sensitiveness. In all cases the balances were in a good Sprengel vacuum.

A ball of ivory was balanced against a ball of brass on a straw beam; the ivory was more sensitive to radiation than the brass.

62. A pith ball and one of platinum of the same weight were balanced on a straw beam. The pith was very sensitive, being readily repelled by the finger; but the platinum was sluggish, and required a spirit-flame to move it.

63. Two pith balls of the same weight, one gilt and the

66. A piece of flat plate-glass, 15 millims. wide and 1.5 millims. thick, was heated in the middle before the blow-pipe till quite soft, and then drawn out till a long ribbon of glass was produced, the width and thickness of which retained the proportions of the original piece. From the middle of this a portion 150 millims. long, 4 millims. wide at the ends, and 3 millims. wide in the centre, was cut off. A double-pointed needle (24) was then secured to the centre by binding with platinum wire and fusing the latter to the glass. This little balance was adjusted until it was very delicate, and was then enclosed in a tube containing potash at one end and platinum wires sealed in at the other end; it was then arranged, in connection with the Sprengel pump and carbonic acid apparatus, so as to produce a chemical vacuum (51, 52, 53).

When the flame of a spirit-lamp was passed under one end of this balance, the apparatus being full of air at the ordinary density, the result was decided attraction (27, 37, 38, 40, 41). On exhausting and testing from time to time in the same manner,† I found the attraction, or rather the sinking of the heated end towards the spirit-flame, to keep at about the same strength until the gauge had risen about 500 millims. After this there was a gradual decline in the downward movement of the glass end of the balance when heat was applied, until the gauge stood about 100 millims. below the barometer. On testing the movement at this pressure I at first thought it was very slight;

* These two metals were taken as representing nearly the two extremes of metallic conductors for heat and electricity, and also being the best (silver) and the worst (bismuth) in the list of "vibrators" given by Professor Forbes in his "Experimental Researches regarding certain vibrations which take place between metallic masses having different temperatures" (*Transactions of the Royal Society of Edinburgh*, 1834, vol. xii., pp. 429–461).

† *Telegraphic Journal*, vol. i., p. 78.

‡ It is perhaps scarcely necessary to say that the apparatus was allowed full time to acquire the ordinary temperature of the laboratory between each of these experiments.

* From the *Philosophical Transactions of the Royal Society of London*, vol. clxiv., part 2.

but on keeping the flame of the lamp for about half a minute below the end of the balance the latter commenced to sink, and then the downward movement was almost as great as ever. With a difference of 95 millims. the phenomena were similar, the lamp, however, requiring to be kept under the balance end longer, and the ultimate movement not being so great. At 90 millims. the same thing occurred, the time of heating having to be still longer.

When the gauge was raised to 85 millims. of the barometric height, and the lamp was applied, the first movement was one of repulsion. The glass end rose instantly, but to a very slight extent. On keeping the lamp under for about a minute, the end of the balance slowly came down, until it had sunk a little below its original position.

At 80 millims. difference between gauge and barometer the effect was almost the same as at 85 millims. The preliminary rise was, if anything, a little more marked. For fear of injuring the connections of the apparatus, I did not like to apply the spirit-flame for a longer time than a minute, as the glass then commenced to soften; I therefore, at the higher exhaustions, paid most attention to the initial movement of the glass beam, merely keeping the lamp beneath long enough to see if the continued heating drew the beam down again.

At a difference of 45 millims. between the gauge and the barometer, the neutral point was about reached. The glass beam was not quite motionless on applying the spirit-lamp; it rose very slightly at first, and then descended to the same distance below the original level on continuing the heat.

At 35 millims. the initial rise was immediate and decided. Continued heat only lowered the end a trifle, but did not bring it down to anything near its original position.

From this point the attraction towards the heat ceased to be perceptible. The upward movement increased in strength and amplitude until the Sprengel vacuum was reached.*

At 10 millims. below the barometer the glass beam was repelled by a glass rod or a lump of copper heated to 100° C.; at a difference of 5 millims. between the gauge and the barometer the finger applied below repelled the beam; and at 2 millims. difference the beam was repelled when the finger was applied above.

In the Sprengel vacuum the beam was very sensitive to the approach of a warm body, a touch of the finger sending it away to the fullest extent.

67. I consider that the difference observed between the behaviour of this glass beam, the straw beam with brass ends (37 to 40), and the straw beam with pith ends (30, 31, 32) is to be accounted for by the different materials forming the balances, the different way in which heat was applied in the three cases, and the extent of surface exposed in proportion to mass. There is, however, much to be found out in respect to the position of the critical point, and I am still at work on the subject.

Carbonic acid was then let into the apparatus, and it was re-exhausted. Not wishing to tax the potash too severely, I did not spend much time during this exhaustion; a few observations were, however, taken at different heights of the gauge, and the position of the neutral point was apparently a little raised. The general results were, however, the same as with air. In a carbonic-acid Sprengel vacuum the repulsion by heat was exactly the same as in an air Sprengel vacuum.

68. The remainder of the process for producing a chemical vacuum was then gone through; the tube was set aside till the potash had done its work, and experi-

ments were then tried with it. To the heat of the spirit-lamp, a warm glass or metal rod, the fingers, or the image of a gas-flame concentrated by a lens, the balance was very sensitive, being instantly repelled to a distance varying with the intensity of the heat. Experiments were tried with different rays of the solar spectrum with a similar result to that described in par. 58. The vacuum was so nearly perfect that an induction-spark would not pass, but preferred to strike across its full distance in air.

69. If one of the most sensitive balances (straw and pith (24), or the glass one last described (66)) in a well-exhausted tube is carefully turned on its side, after a little practice the beam can be balanced on one point of the suspending-needle, which will be nearly vertical. In this position the beam has a horizontal movement; and by carefully adjusting the level of the tube the delicacy of the beam can be made very much superior to what it would be suspended in the ordinary way. By bringing a warm body near one end of the balance, it is now driven away to the utmost extent, and a piece of ice attracts it with equally marked energy.

70. On trying this experiment in air of ordinary density, the approach of a hot body causes unmistakable attraction, and a cold body repulsion. In a vacuum this mode of arranging the apparatus did not at first appear to offer advantages over the plan already adopted; but as from the direction of movement it was not likely that air-currents could interfere, or, at all events, not to any great extent, I have arranged apparatus for obtaining the movements of repulsion and attraction in a horizontal instead of a vertical plane, so as to examine the action in air.

Instead of supporting the beams on needle-points, so that they could only move up and down, I suspend them by the centre to a long fibre of cocoon-silk in such a manner that the movements would be in a horizontal plane. With apparatus of this kind, using very varied materials for the index, enclosing them in tubes and bulbs of different sizes, and experimenting in air and gases of different densities up to Sprengel and chemical vacua, I have carried out a large series of experiments, and have obtained results which, whilst they entirely corroborate those already described, carry the investigation some steps further in other directions. I propose shortly to submit an account of this second series of researches to the Society.

71. I have more recently instituted experiments to ascertain how far the action of gravitation in Cavendish's celebrated experiment is likely to be modified under the influence of heat. For many months I have been experimenting with apparatus devised for this purpose. The investigation is not sufficiently advanced to justify further details, but I may perhaps be permitted to give here an outline of one of the results.

72. I find that a heavy metallic mass, when brought near a delicately suspended light ball, attracts or repels it under the following circumstances:—

- I. *When the ball is in air of ordinary density.*
 - a. If the mass is *colder* than the ball, it *repels* the ball.
 - b. If the mass is *hotter* than the ball, it *attracts* the ball.
- II. *When the ball is in a vacuum.*
 - a. If the mass is *colder* than the ball, it *attracts* the ball.
 - b. If the mass is *hotter* than the ball, it *repels* the ball.

73. The density of the medium surrounding the ball, the material of which the ball is made, and a very slight difference between the temperatures of the mass and the ball exert so strong an influence over the attractive and repulsive force, and it has been so difficult for me to eliminate all interfering actions of temperature, electricity, &c., that I have not yet been able to get distinct evidence of an independent force (not being of the nature of heat or light) urging the ball and the mass together.

Experiment has, however, shown me that, whilst the

* In these and many of the other observations accurate measurements were taken of the extent of movement by means of a micrometer-eyepiece, and the time was also accurately noted by a seconds' watch. As, however, the equal and uniform delicacy of the instrument could not be depended upon, I think it best only to give the results in general terms rather than to mislead by an affectation of accuracy not justified by the instrumental means employed.

action is in one direction in dense air, and in the opposite direction in a vacuum, there is (as I have already pointed out with the balances) an intermediate pressure at which differences of temperature appear to exert little or no interfering action. By experimenting at this critical pressure, and at the same time taking all the precautions which experience shows are necessary, it would seem that such an action as was obtained by Cavendish, Reich, and Baily should be rendered evident.

(To be continued.)

FLUORESCENT RELATIONS OF CHRYSENE AND PYRENE.

By Professor HENRY MORTON, PH.D.

(Continued from page 36).

Maxima and Minima of Fluorescence.

WHEN a pure spectrum is thrown upon a screen coated with solid chrysene, maxima of fluorescence are seen at certain parts, just as is the case with chrysogen and thallene. The accompanying figure will make this clear.

A solar spectrum about an inch broad and 7 inches long is thrown on a paper screen, and the adjustments are made

of darkness, extending, as it were, from the opposite side of the tank, and, in fact, representing the absorption correlative with the maximum of fluorescence which the bright portion represents.

In other words, the actions which the whole phenomenon involves (as was first shown by Stokes in the case of a solution of chlorophyll) are these.

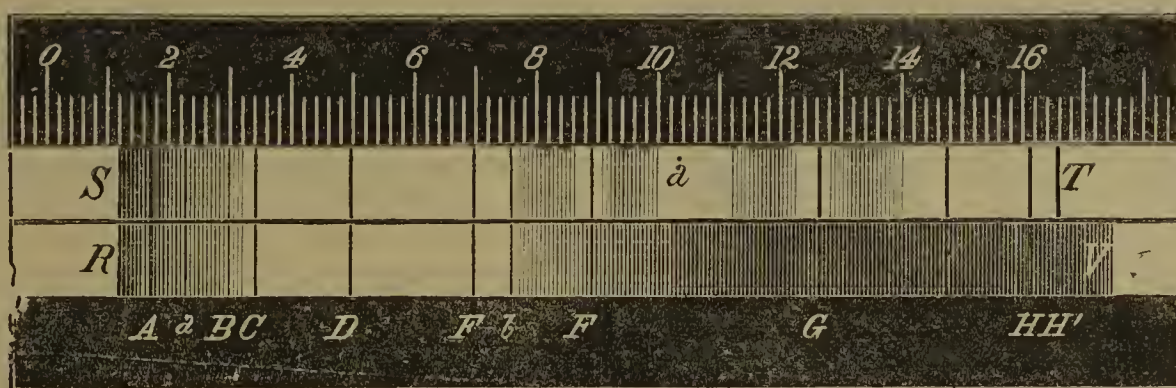
Light vibrations of the particular wave-length which compose this portion of the spectrum are particularly effective in exciting fluorescence in this solution.

They consequently produce a strong action on the solution as they enter it, but just because their energy is converted into this new form must it be rapidly expended or absorbed. Hence, just these rays which are most active are least able to penetrate into the solution, being used up in producing fluorescent light.

The rays at either side of these, being equally intense, but not so capable of converting their energy into fluorescence, produce less effect, and so travel further into the solution before their power is expended.

Beside the bright spot near F, we find another also of a light green tint below G, with its corresponding blade of absorption, while another bright region begins above G and extends to the limit of the spectrum, being, however, confined more and more closely to the entering surface as it ascends.

FIG. 1.



until the principal Fraunhofer lines can be readily distinguished.

For the simple paper screen is then substituted one in which the space, S T, is coated with chrysene.

We then have an appearance such as is indicated in the figure.

At R V is seen the ordinary solar spectrum fading gradually away from a bright orange, at D, to an almost invisible violet at V, while above, at S T, where the same light falls on the chrysene, we have the upper part of the spectrum almost as bright as the lower, and of a greenish hue, in which we see, well defined, the Fraunhofer lines, and spaces of special brightness, about F or between 8 and 10 of the scale, at *a* or between 10 and 10.5 of the scale, and about G or between 12 and 12.5, and a portion of yet more vivid green extending from 13 upwards for a distance depending upon the transmitting power of the prism used, for extra violet or actinic rays.

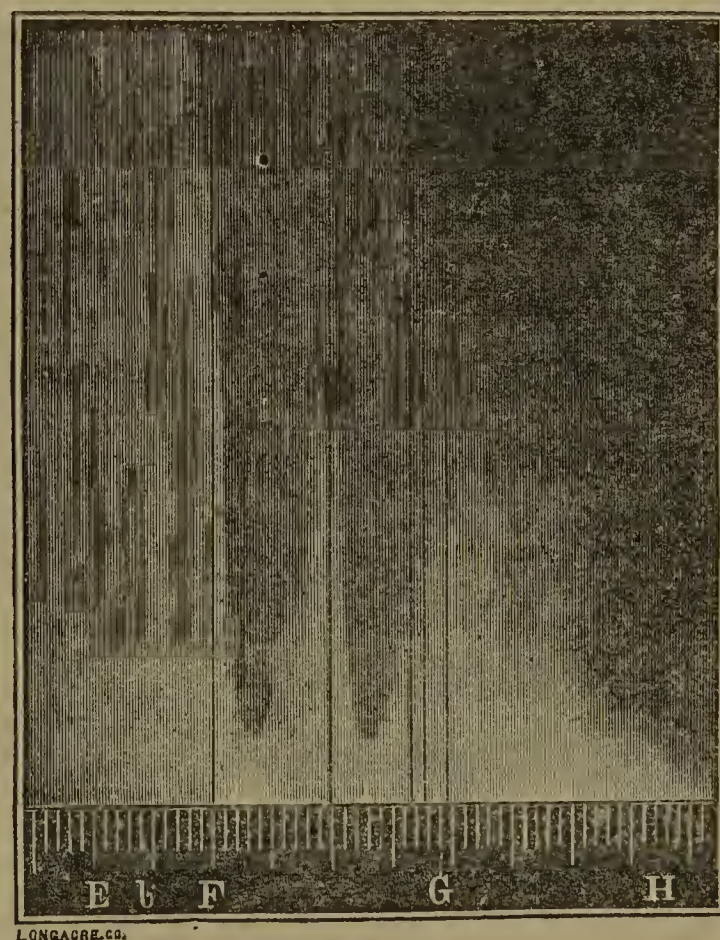
If a strip of paper coated with anthracene rich in chrysogen is placed at R V, the maxima of brightness on this and on the chrysene are seen to correspond in position, but in the case of the chrysogen the spaces between the maxima are much darker than with the chrysene. Otherwise, the action is much alike with these two substances, and in both cases the maxima correspond with absorption-bands which will be described further on. When the same pure spectrum is thrown on the side of a rectangular tank filled with a cold concentrated solution of chrysene in benzol, the appearance presented is that indicated in the accompanying cut (Fig. 2).

Below F, a broad faint illumination of a yellowish green tint reaches far into the tank. A little above* F is a portion of brilliant green, exactly against which comes a blade

* I.e., to the right of, in cut. Called above because towards the violet or upper end of the spectrum.

The principal Fraunhofer lines are readily seen in this experiment, as indicated in the cut.

FIG. 2.



Compared with a similar solution of anthracene containing chrysogen treated in like manner, the chief difference is, that the maxima and absorption blades are less

sharply defined in the solution of chrysene than in the other substance.

If the solution is diluted, the maxima of fluorescence become less intense, but stretched further into the solution, so pushing back the blades of absorption, and thus giving quite a different general effect, although a careful comparison shows the really close relation of the actions.

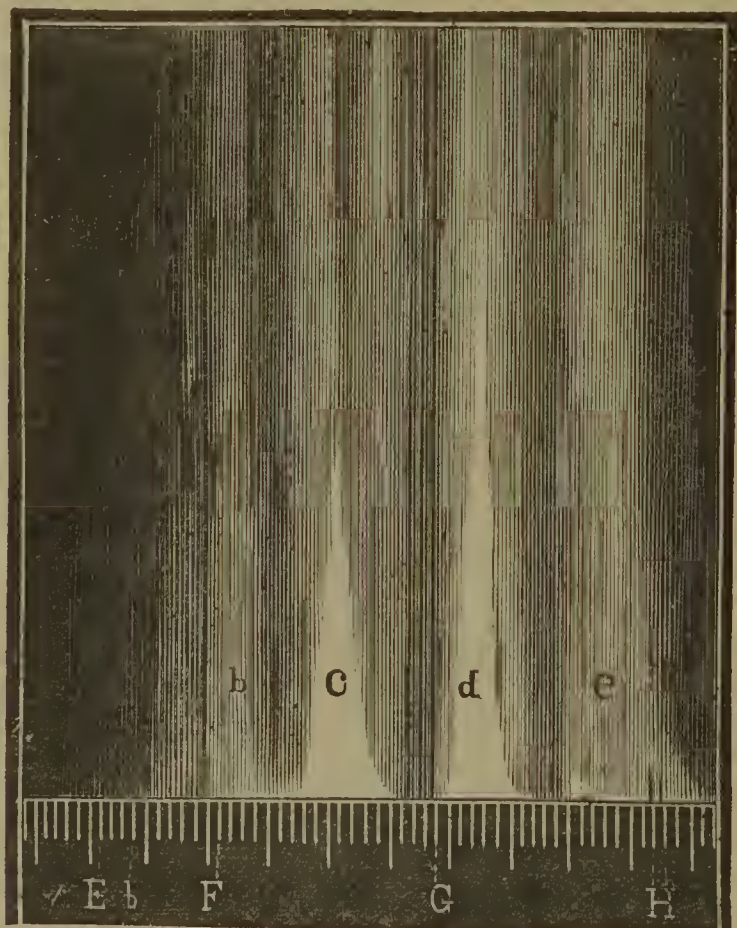
By a yet further dilution the absorption blades may be lost, or, as it were, driven beyond the further side of the tank, and also losing definition by being more gradual and blended.

FIG. 3.



The two accompanying cuts, Figs. 3 and 4, taken in connection with Fig. 2, will sufficiently illustrate this point, though they represent a different substance, *i.e.*, thallene.

FIG. 4.



But, while the colours and exact character of bands differ conspicuously in these materials, their general arrangement and actions are precisely similar.

Fig. 3 shows the effect where a weaker solution is used, causing the exciting rays to reach further and to push back the blades of absorption; and Fig. 4 shows a yet weaker solution.

If we employ a solvent in which the substance is less soluble, just such a change as would result from dilution will be observed, though to this in certain cases may be added other modifications, such as an upward displacement of the maxima, or the disappearance of some of them.

Thus while Fig. 3 represents the appearance seen with a solution of thallene in benzol, Fig. 4 is that given by a solution of the same substance in ether. If, however, the latter drawing were to represent a dilute benzol solution of the same, no change would be required except a slight downward displacement of some bands or maxima.

Effects of Solarisation.

As we have already noticed, Liebermann found that he was not able by exposure to sunlight to remove the yellow colour from chrysene though this method is so effective with anthracene. By greatly intensifying the action, that is to say, by keeping a boiling solution of chrysene in benzol for over thirty minutes in the focus of a lens of 14 inches diameter, we have succeeded in entirely changing the material to which the chrysene owes its yellow colour and brilliant fluorescence as above described. The quantity of solution treated at one time was about two fluid-ounces. On exposing such a hot solution for ten minutes in the focus of the lens, there is deposited a material of a cream colour, which shows a very faint fluorescence compared with that of the ordinary yellow chrysene, and whose spectrum of fluorescence is faint and badly defined, but yet indicates an upward displacement of its bands, as appears from the following table:—

Bright bands.	1st.	2nd.	3rd.	4th.	5th.
Yellow chrysene	41.7	55.0	70.5	85.5	
Chrysene solarised 10'	42.1	56.9	73.5	91.0	108.8

A fifth band also makes its appearance in the solarised material as in the solutions, which is not perceptible in the yellow chrysene.

These changes, it may be remarked, are quite similar to those found in thallene (see CHEMICAL NEWS, vol. xxvi., p. 272), but I have not found any such action where anthracene containing chrysogen is placed under similar conditions. In that substance the fluorescence of the coloured constituent is simply destroyed by the action of sunlight on the hot solution without any preliminary displacement of bands.

This displacement of bands by solarisation in solution, taken in connection with the similar displacement by mere solution in certain liquids, gives a hint at that close relation between solution and chemical action which we have also found more definitely indicated in the reactions of uranic double salts in a like connection (see CHEMICAL NEWS, vol. xxviii., p. 47, &c.).

Absorption Bands.

If a little yellow chrysene is mixed with melted paraffin and pressed into a thin sheet between two slips of glass, or in any other way reduced to a thin sheet through which light can pass, the transmitted beam will be observed to have certain bands of absorption similar to those seen under like conditions with impure anthracene.

The general absorption of all the upper rays is, however, relatively greater, and thus these bands are the more difficult to recognise and measure.

The various solutions of the same substance, however, shows these bands with great clearness, and their positions are given in the following table:—

Absorption Bands of Chrysene.

Bands.	1st.	2nd.	3rd.
Solid chrysene	89.7	105.3	126.7?
Benzol solution	96.3	117.0	
Chloroform solution ..	95.9	116.4	
Ether solution	99.5	121.1	152.8?
Turpentine solution ..	97.5	119.6	

These bands resemble those given by anthracene and by thallene in their general character and in their displacement by a change of solvent, but like the bands of fluorescence seem to occupy positions higher in the spectrum, with the exception, perhaps of the bands of the solid, which hardly appear appreciably different in the case of anthracene and chrysene.

In conclusion, we would observe that from all the phenomena we are of opinion that the substance to which chrysene owes its colouring is not identical with that which gives its tint to ordinary anthracene, and described by Fritsche as chrysogen, but is a distinct though closely analogous substance.

(To be continued).

NOTE. After the above was written we noticed in the CHEMICAL NEWS of August 14th, 1874, the brief description by Dr. Phipson of the new substance chrysenene obtained by him from crude chrysene.

We do not agree with him, however, in thinking it identical with the substance above described, as its fluorescence yields a continuous spectrum in place of the banded one above described. Our experiments, indeed, demonstrate that quite a number of coloured bodies are present in the crude product which are soluble to very different degrees in different solvents, and are thus removed from the chrysene before it reaches the condition in which it was studied as above.

We do not doubt that Dr. Phipson will agree with us in this conclusion after a spectroscopic observation of the fluorescent light emitted by these substances.

This seems indeed to be just one of the cases in which the fluorescent spectrum of a substance is invaluable as a means of discrimination.

A STUDY OF CONDENSATION RADICALS.

By S. E. PHILLIPS.

OF the allotropic peculiarities of the so-called elementary substances we know comparatively nothing; of similar peculiarities in compound bodies we know much, and crave to know more, especially in relation to their volumes and specific heats.

As is becoming for an amateur student, most of my papers are of an enquiring turn, and in this case I write on a subject where ignorance may well be excused.

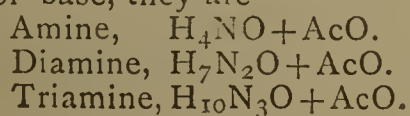
Mr. Wright has made himself eminent by very extended researches upon morphia and codeia condensations; and the essential enquiry is, why he should regard these bodies, normally or initially, as di-ammonias rather than ammonias, as more generally understood?

As in previous enquiries I have laid stress on some features not accepted by most English chemists, so in this case I must beg indulgence, in mooted that the methods employed by Hofmann, Würtz, Odling, and others, to represent amine condensations are incorrect, and that an extended survey of the field justifies me in maintaining that, if the amine radical be represented by (H_4N) , the diamine will not be (H_8N_2) , but (H_7N_2) , the triamine $(H_{10}N_3)$, the tetra-amine $(H_{13}N_4)$, &c.

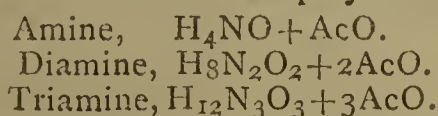
While fully ninety-nine out of one hundred analyses necessitate this view, it is not denied that some few exceptional cases, which may be real or apparent, do involve such ratios as H_8N , $H_{12}N_3$, &c. Di-pyridine is a case in point, but for a comparatively extended series the morphia-codeia condensations of Mr. Wright are particularly conspicuous.

If it be worth while to dignify these exceptional cases by a comparison with such as involve almost universality, the task is easy.

The true poly-amines are normally monatomic, and using acetic acid (AcO) in a representative sense, to cover any hydrate, acid, or base, they are—



The exceptional amines are all polyatomic—

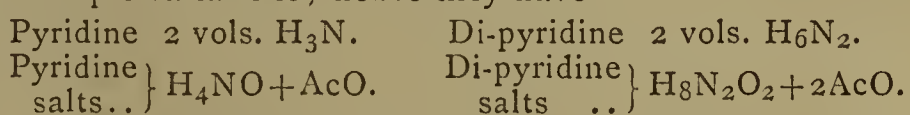


Wright's tetra-amines would be octamines if, as generally understood, morphia be one N body, and hence the great distinction—



In one case we have a condensed radical with a normal saltic type, whether it be an oxy or a chloro salt; in the other case, we have the entire condensation of the whole saltic body *per se*, and the chloride would be Cl_8 ! In the case of di-pyridine, the constitution depends, perhaps, wholly upon the volumetric point of view entertained.

Most English chemists maintain that chemical considerations should be subordinated to those of vapour density and specific heat, strangely ignoring the fact of their multiple variations; hence they have—



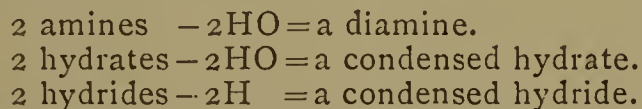
It would, therefore, appear in this case that the condensation takes place first in the radical, or ammonia form, and that O_2 , or Cl_2 , and 2 of acid are subsequently added!

Per contra, there are those who think that the laws of vapour density and specific heat require much further investigation, and while the facts of multiple variation continue to increase, that chemical considerations should not rashly be laid aside.

Why may we not have ordinary pyridine (2 vols.) and allotropic pyridine (1 vol.)? If certain chemists could but divest themselves of preconceived "idealities," and look the matter fairly in the face, they might possibly find hosts of 1 vol. hydrides and ammonias!

As occupying a lower platform, an outside, independent position between these two aspects, we think it quite possible to devise simple reactions, which should finally determine, *apart from all hypothesis*, whether dipyridine (so-called) have one or two N constituents; in other words, whether it be a condensed allotropic pyridine, a normal di-ammonia, or an exceptional di-salt entering the curious category which is the special subject of this enquiry.

Meanwhile, we pass on to a consideration of the parallel condensations of the simpler hydrocarbons. The general law would seem to be—



The generality of this law has often been overlooked by chemists, who have abundantly supplied the explanation of what might otherwise appear a deviation from the law.

Both di-hydrides and dihydrates are often represented as of simply a condensed dedoublement of the same atomic weight, it being clearly understood that the 2H or 2HO eliminated in the nascent state have a manifest tendency to combination; but it is not so clearly discriminated that in every such case an alteration of type or series subsists.

As an instance of "polymeric condensation," M. Barbaglia cites the tri-isobutyl-aldehyde, $C_{24}H_{24}O_6 = 3(C_8H_8O_2)$; or M. Prunier gives the di- and tri-propylenes, (C_6H_6) , $(C_{12}C_{12})$, $(C_{18}H_{18})$.

Such cases are very frequent among aldehydic bodies, with their known tendency to assimilate nascent hydrogen, and in some few cases the HO of an alcohol or hydrate is similarly absorbed; but in all cases they are evident departures from the pervading law, and such exceptions give no countenance whatever to the amine anomalies. The resulting di-hydride or di-aldehyde, whether normal or otherwise, in no case being di-atomic!

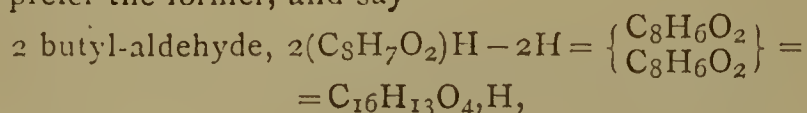
Propylene is a hydride of the radical (C_6H_5) , the radical itself a condensation to 1 vol., the hydride being normally 2 vols.

Propylene + propylene - 2H = $\left\{ \begin{smallmatrix} C_6H_4 \\ C_6H_5 \end{smallmatrix} \right\} = C_{12}H_9, H =$ the true di-propylene.

This body + 2H = $C_{12}H_{11}, H =$ the di-propylene of M. Prunier.

A slight digression as to the aldehyde type may, perhaps, be allowed, inasmuch as I am often perplexed as to whether the aldehydes and essential oils may be best regarded as hydrides or weak alcohols.

In the case of M. Barbaglia, it may seem most feasible to prefer the former, and say—



which, absorbing 2 nascent H in the reaction, becomes $C_{16}H_{15}O_4, H$ as his di-aldehyde; and similarly with the tri-condensation.

If he had, with the enlightened penetration of M. Schiff, wisely gone further, and proved that the di-condensation gave an ammonia, $(C_{16}H_{15}O_4)H_2N$, on the tri-form an amide derivative, $(C_{24}H_{23}O_6)H_2N$, then it would have gone far to justify this aspect; but, pending this, it is certain that an enormous majority of aldehyde reactions are simply conformable to the all-pervading law of—

Hydrate + hydrate - 2HO = the di-compound;

and beyond this, it is noticeable that the simplest and best known alcohols are, in some extreme cases, subject to the same peculiarity.

I have long regarded Dr. Richardson's tribasic ethers as in all probability a great misnomer and mistake; but how to represent the generic reaction, except as above, I know not.

As hydride of glycol, $(C_4H_5O_2)H$, would be isomeric with alcohol, $(C_4H_5)O + HO$, so ethylate of sodium may be represented as $(C_4H_5)O + NaO$ or $(C_4H_5O_2)Na$. If G represent, *pro tem.*, the glycol radical, then we have—

Chloroform, $C_2Cl_3, H + 3GNa = C_2G_3, H$, or $C_{14}H_{15}O_6, H$, and 3NaCl.

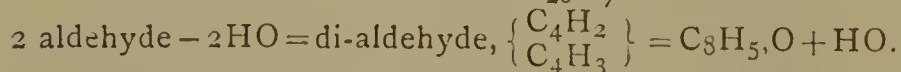
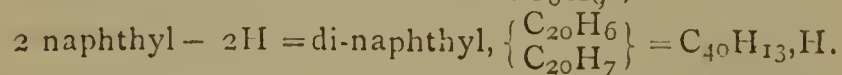
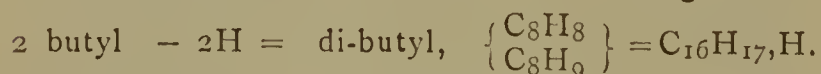
In the case of methylic sodium, we have the so-called tri-methylic ether = $C_8H_9O_6, H$, which is isomeric with diglycol.



That the latter would give an amide derivative, $(C_8H_9O_4)H_2N$, is quite certain, and if the former gave $(C_8H_9O_6)H_2N$, the hydride aspect would again be justified.

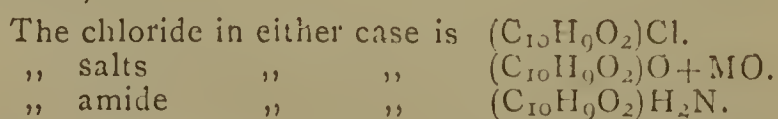
The issue of this digression has a direct bearing on the proper use of type representations, which may be convenient and even necessary feelers after truth. But, if we could know the actual arrangement of atoms in an alcohol, the probability is that a divine simplicity would be revealed, superseding both types and evincing both expressions under varied conditions.

To resume, it is quite clear and acknowledged that—



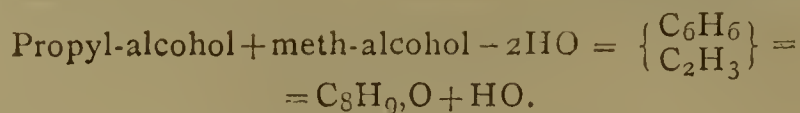
Acetic acid + 3 meth-alcohol - 6HO = trimethyl-acetic acid.

This being an isomer of valerianic acid, and giving the general reactions of that body with certain allotropic differences,—

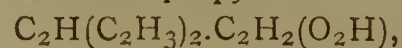


These allotropic differences may be well represented in the butyl-alcohols.

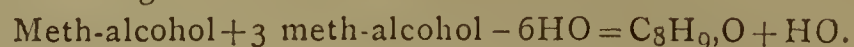
Armstrong calls the normal body propyl-carbinol, $(C_6H_7)C_2H_3(O_2H)$. Having halved his diatomic elements; I regard the meaning to be—



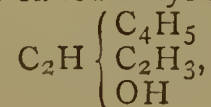
The iso body is called iso-propyl-carbinol—



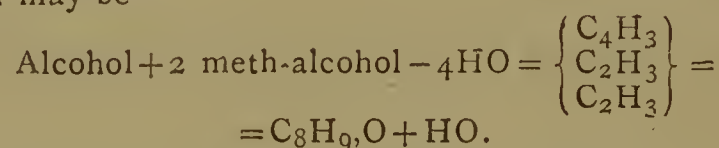
which I regard as—



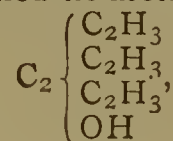
The secondary body is called ethyl-methyl-carbinol—



which may be—



The tertiary body is called tri-methyl-carbinol—



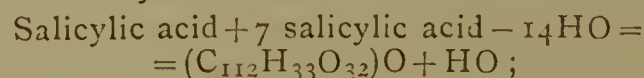
which I regard as—



A difficulty here occurs, as two of these bodies are interpreted to mean the same thing, while one boils at 109°, the other at 82.5°. I then look for the propylic constituents of Nos. 1 and 2; and Armstrong says "only two modifications of propylic alcohol are known, the normal, or ethyl-carbinol, $C_4H_5 \cdot C_2H_2 \cdot O_2H$, and iso-propylic alcohol, or dimethyl-carbinol, $C_2(C_2H_3)_2H \cdot (O_2H)$." This apparently justifies my interpretation; but of such groups as C_2 or (C_2H_2) I know nothing, nor do I accept such principles of notation.

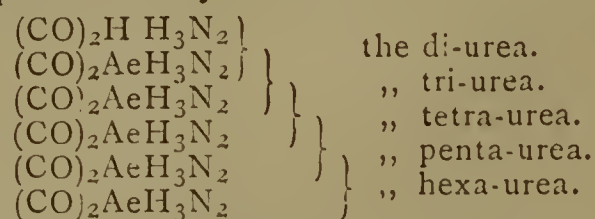
Omitting the iso body, these may be true representations of allotropic genesis, but the curious thing to notice is, that under varied conditions they are convertible into each other. If from the amide, $(C_8H_9)H_2N$, from No. 1 we reproduce the alcohol, it is found as No. 2, and a repetition of the process yields No. 4. The prevalence of this law is well seen in the infinity of glucoside condensations, where the genius of M. Schiff has been so eminently conspicuous.

Several very extended condensations have been obtained with enanthol, salicyl, benzoic aldehyde, and similar bodies. We only notice two of these:—



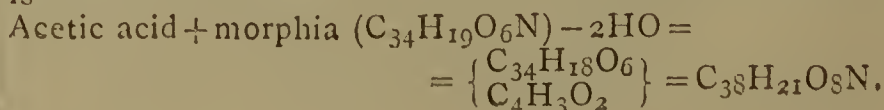
7 atoms of the salicyl radical being condensed into 1 of salicylic acid, and if the amide were obtained, there is no question but that it would be $(C_{112}H_{33}O_{32})H_2N$.

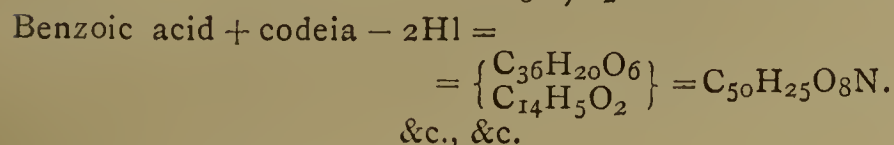
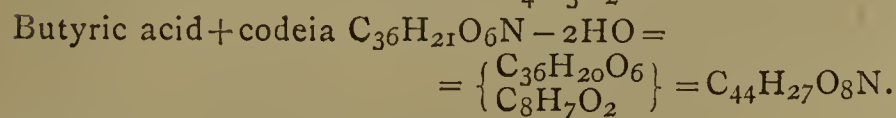
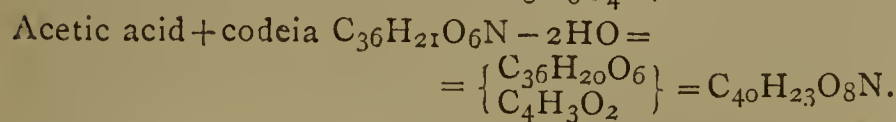
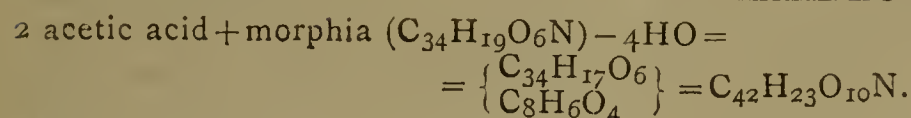
The action of enanthol upon urea has given a 12-fold condensation of ammonia. If the hydride be employed, it is, successively, hydride + ammonia - 2H. If enanthol be employed, it is, similarly, hydrate + ammonia - 2HO; and, calling enanthyl $C_{14}H_{13}, H = Ae$, we may notate the body called "penta-enthyl-hexamine," as thus:—



Otherwise, $(CO)_{12}Ae_5H_{19}N_{12}$ or $(H_{36}N_{12})$. It is improperly called a hexamine; but how it would behave as such may clearly be seen by the analogous "ethylenic di-urea," $(CO)_4(C_4H_3)H_7N_4$. "It retains the character of a simple atom of ammonia: it is a monacid tetramine;" hence the Pt salt is $(CO)_4(C_4H_3)H_8N_4Cl + PtCl_2$.

Freely interpreting Mr. Wright's very recent papers on morphia and codeia, I would say that his acetyl-morphine is—





And the question again arises, why should all these be doubled, and the chlorides have 2 Cl and the salts 2 atoms of acid?

It is a poor remark to say that most other chemists regard these alkaloids as 1N bodies, because Mr. Wright has made the subject one of special and very extended investigation.

I find in Watts's "Dictionary" the following oxy-morphia derivatives:—

Oxy-morphia,	$\text{C}_{34}\text{H}_{19}\text{O}_8\text{N}.$
The chloride,	$\text{C}_{34}\text{H}_{19}\text{O}_8\text{NHCl}.$
„ chloro-platinate,	$\text{C}_{34}\text{H}_{19}\text{O}_8\text{NHCl} + \text{PtCl}_2.$
„ nitrate,	$\text{C}_{34}\text{H}_{19}\text{O}_8\text{NHO} + \text{NO}_5.$
„ hydrate,	$\text{C}_{34}\text{H}_{19}\text{O}_8\text{NHO}.$
„ „	$\text{C}_{68}\text{H}_{38}\text{O}_{16}\text{N}_2\text{HO}!$

It is a misnomer to call these hydrates, because there is no HO of hydration corresponding with the acid constituents—they are truly oxides of the ammonium of which morphia is the ammonia; and the notable thing to observe is, that the doubled, or di-ammonium, is an illustration of the wide, if not universal, law of diamines we have essayed to enforce.

In contradistinction from these, Dr. Wright's iodides are N_22HI ; the di-iodide, N_{44}HI ; the tetra-iodide, N_{88}HI .

The very great labour, skill, and penetration involved in Dr. Wright's researches demand the very highest respect; and if I have appeared to dwell unduly on a diverse aspect, it is only with the sincere desire to understand peculiarities towards which I can see only the very faintest clue.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

Saturday, January 16th, 1875.

Professor J. H. GLADSTONE, F.R.S., President, in the Chair.

THE usual fortnightly meeting was held at the Physical Laboratory, South Kensington. Messrs. W. H. Perkin, F.R.S., C. H. Lemann, and W. Bottomley were elected members.

A paper was read, by the PRESIDENT and A. TRIBE, Esq., "On the Electrolysis of certain Metallic Chlorides." If metallic copper be immersed in solution of cupric chloride, insoluble cuprous chloride is formed upon it. The authors found that, if a strip of platinum be connected with one of copper, and the two immersed, the insoluble cuprous salt was also deposited upon the platinum. Attributing this result to the electrolysis of the cupric salt by a feeble current, they tried the effect of a zinc platinum cell excited by common water, and with platinum electrodes in the cupric chloride (2 to 10 per cent). Cuprous chloride appeared at the negative electrode, and chlorine at the positive. An ordinary Grove's cell also gave cuprous chloride for the first two or three minutes, but afterwards metallic copper. A zinc and a platinum plate were joined, and immersed in cupric chloride; cuprous chloride was

deposited upon the platinum, the edges being encrusted with metallic copper. With magnesium in place of zinc, a larger proportion of copper was obtained. Precisely analogous results were obtained, mercurous and ferrous chloride appearing at the negative electrode.

A communication was made by Professor GUTHRIE, "On Salt Solutions and Attached Water." Continuing the direction of research previously indicated, the results of which were communicated to the Society in November last, the author described the following facts:—Contrary to the generally-received opinion, the minimum temperature attainable by mixing ice with a salt is very independent of the ratio of the two, and of their temperature and of the state of division of the ice. The temperature of a mixture of ice and a salt is as constant and precise as the melting-point of ice. The nine salts resulting from the union of potassium, sodium, and ammonium, on the one hand, and chlorine, bromine, and iodine on the other, were examined in reference to their cryo-hydrates, the temperatures of the formation of which range from -28° to -11°C . For the same halogen, sodium salts assume less water than ammonium, and ammonium less than potassium. For the same metal, iodine salts assume less water than bromine, and bromine salts less than chlorine. The result of the examination of thirty-five salts establishes the identity of the temperature at which the cryo-hydrate is formed, with the temperature got by mixing the salt with ice. Only two apparent exceptions to this identity have been as yet observed. The temperature at which a cryo-hydrate is formed is, with these exceptions, lower according as it assumes a less molecular ratio of water. There appear to be no exceptions to the rule that the lower the temperature got by mixing the salt with ice, the lower the molecular ratio of water. The temperature of incipient solidification of spirits of wine of different strengths was also examined. It was found that from spirits containing more water than the 4-molecule hydrate pure ice was separated, and that the temperature gradually sank to -34° , when the ratio of the 4-molecule hydrate was reached; thence the temperature remained constant, and the whole solidified into a hard mass. When a spirit richer than this cryo-hydrate is cooled, the cryo-hydrate separates, and stronger and stronger spirit is left, which ultimately defies the source of cold to solidify it. Professor A. Dupré's experiments regarding the maximum temperature produced on diluting alcohol are thus singularly confirmed, for this experimenter showed that this very 4-molecule ratio produced the greatest heat in its formation. Ethylic ether, which dissolves water and is dissolved by it, seems to form a definite cryo-hydrate. Water saturated with ether solidifies at -2°C ., without separation of ether; the icy mass so got, when ignited, burns with a colourless flame, the heat of which just suffices to melt the ice.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 26, December 28, 1874.

This number is taken up with accounts of the prizes awarded by the Académie for researches, and reports of the speeches delivered on the occasion.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin, No. 14, October 26, 1874.

Notices towards a Knowledge of Sulph-Urea and Guanidin.—W. Weith.—This paper treats of the action of sulphuretted hydrogen upon carbo-diphenylimid, and upon sulpho-carbanilid; the dissociation α -triphenyl-

uanidin; and the action of bisulphide of carbon upon arbo-diphenylimid.

Various Communications.—V. Meyer.—These consist of researches on the aromatic sulph-acids, by E. Mölling; a paper on the esters of the mercaptans, by W. Michler; and on dibrom-ethan, by V. Meyer.

Communications from the Laboratory of the University of Göttingen.—H. Hübner.—This paper includes a memoir on benzanilid and nitric acid, by C. Stöver; one on isomeric mono-nitro-benzo-naphthyl-amids, and their various behaviour with hydrogen, by P. Ebell; on benzoyl-amido-phenols, by H. Morse; on nitrosalicylic acids, by L. B. Hall; and on amido-benzo-nitriles, by A. Fricke.

Preliminary Communications.—J. Post.—The author is engaged with the study of the chemical and physical properties of all known nitro derivatives of phenol for the purpose of solving the "questions which at present impel chemical research, namely, the respective position of atoms and groups of atoms in the molecule."

Contribution to the History of the Phenomena of Fermentation.—H. Struve.—A comment on Traube's paper "On the Behaviour of Alcoholic Yeast in Media free from Oxygen Gas" (*Berichte*, No. 11). He complains that the researches undertaken by Döpping and himself—the result of which was put forward by Liebig in his "Chemical Letters" (1865, p. 18)—have been completely overlooked. These experiments on fermentation have never been repeated by Pasteur. He avoided it, as they could not be brought to harmonise with his theory.

The Law of Multiple Deviations.—E. Mulder.—The power of molecular rotation, which certain compounds of carbon possess in solution, can be modified by different agencies. In general, we have to distinguish a stable and an unstable modification of molecular rotation. As an instance of the former we may take tartaric acid. Dextro-tartaric acid can be transformed into uvic acid (a compound of dextro- and lævo-tartaric acid); therefore, dextro-tartaric acid is capable of interversion into the lævo-tartaric. Since uvic acid, as is generally admitted, remains optically indifferent under various agencies which affect the rotation of dextro-tartaric acid, the inference may be drawn that the molecular rotations of dextro- and lævo-tartaric acid, under similar circumstances, are respectively equal and opposite. If we assume with Landolt for the molecular rotation of dextro-tartaric acid,—

$$(\text{M})n = +21.08, 10,$$

then the molecular rotation of lævo-tartaric acid, under similar circumstances, is $(\text{M})n = -21.08$. The inversion in question takes place only in accordance with the law of multiple rotations. As to the unstable modification of molecular rotation, there are carbon compounds whose molecular rotation is temporarily modified by certain agencies, and which return to their original rotatory power as soon as these agencies are withdrawn. Thus the molecular rotation of dextro-tartaric acid is temporarily modified by bases. (See Landolt, *Berichte*, vi., p. 1075.) A continued study of these modifications of molecular rotation may be of exceedingly great value in its scientific applications. The author names merely the study of the influence of salts upon salts, of acids upon salts when an optically active base or acid is present, by means of which we are enabled to trace the chemical decomposition quantitatively by means of polarised light.

Anhydrous Phloroglucin.—H. Hlasiwetz.—In the July number of this journal, p. 891, Piccard makes a communication on this body, $\text{C}_{12}\text{H}_{10}\text{O}_5$, and remarks that, to the best of his knowledge, it has not been previously described: the author has described it nine years ago. See *Transactions of the Vienna Academy*, I., II., 2 abth., p. 84.)

Detection of Alkaloids in Dead Bodies.—W. Schwanert.—Already noticed in the CHEMICAL NEWS.

Rauite—a New Mineral from Brewig in Norway.—S. R. Paykull.—The mineral in question occurs in the Island Lamö, near Brewig. It is a blackish grey zeolite of finely granular texture, and must be a metamorphosis of Elaeolite, as it manifestly undergoes transition into the latter mineral. Its composition is—

Silica	..	..	..	..	39.21
Alumina	..	..	..	..	31.79
Ferric oxide	..	..	..	..	0.57
Lime	..	..	..	..	5.07
Soda	..	..	..	..	11.55
Water	..	..	..	..	11.71

99.90

It approximates closely to Thomsonite. It is perfectly devoid of lustre, and contains traces of foreign bodies, as horn-blende, &c. Its sp. gr. = 2.48, hardness = 5. It is not met with crystalline.

Bulletin de la Societe Chimique de Paris,
No. 11, December 11, 1874.

At the monthly meeting of the Society, November 6, M. Fordos described his experiments on the action of alimentary and medicinal substances upon vessels of plum-biferous tin in presence of air. Wine and vinegar rapidly take up lead in however small proportion it may be present.

MM. Friedel and Guérin announce that they have obtained an oxychloride of titanium. The compound was previously observed by Ebelmen, who took it to be the protochloride. It is produced by passing a current of hydrogen and of tetrachloride of titanium through a tube heated to bright redness, and containing titanous acid. Sesquichloride, Ti_2Cl_6 , is formed simultaneously. The oxychloride: it appears in brown rectangular lamellæ, which are red by transmitted light, and under the polarising microscope present the characters of orthorhombic bodies. Its composition is $\text{Ti}_2\text{O}_2\text{Cl}_2$. If treated with ammonia it yields titanous acid, with disengagement of hydrogen, resulting from the oxidation of the sesquioxide of titanium. The titanous acid in the tube is transformed into a crystalline mass of a fine coppery metallic lustre. It is the sesquioxide, Ti_2O_3 , and presents exactly the crystalline form of oligistic iron ore from Elba. This identity of form confirms the explanation which M. Friedel has already given of the varying composition of titaniferous irons. They are merely mixtures of isomorphous compounds.

M. Thiercelein explained his process for extracting the iodine contained in phosphate of lime.

M. Schützenberger communicated the first results of a series of experiments on albumenoid bodies. He has studied especially the prolonged action of a boiling solution of baryta upon these compounds, as well as that of dilute boiling sulphuric acid for a limited period. He finds in the first case a notable evolution of ammonia at the outset, but which by degrees ceases entirely. The ammonia evolved represents about one-ninth of the total nitrogen of the albumen in question. There are formed at the same time oxalate and sulphate of baryta. The filtrate, when freed from excess of baryta by a current of carbonic acid, still contains a little baryta in the form of a soluble salt of complex composition. Almost the totality of the albumenoid body is converted into crystalline amidic compounds, such as tyrosin, leucin, and inferior homologues. The disengagement of ammonia during the action of baryta tends to show that one part of the nitrogen, one-ninth at most, is found in the albumen in the form of urea. The following experiment supports this view:—Coagulated albumen, heated for some time with sulphuric acid diluted to the tenth, is split up into two parts almost equal—the one, insoluble in water, but soluble in alkalies (containing C, 53.3, H, 7.2, N, 14.2), the other, soluble in water, and precipitable by mercuric nitrate, is very similar to Mulder's teroxide of protein. The mercurial precipitate, decom-

posed by sulphuretted hydrogen, gives, on evaporation, an amorphous product containing C, 50.01; H, 6.5; N, 14.5. This product, on ebullition with baryta, yields a little ammonia and carbonate of baryta. The ammonia and carbonic acid formed are in a ratio corresponding to that which urea demands.

Amongst the soluble products obtained by the action of sulphuric acid, there is formed a substance presenting the characters of glucose.

M. Gautier added the following observations:—When caustic potash is heated with a little water, and dry albumen is gradually thrown into it, a small quantity of ammonia is evolved if the heat does not exceed 250°. The product, dissolved in water and saturated with sulphuric acid, gives off an insupportable odour of excrements. Alcohol extracts from this product leucin, 12 to 15 per cent in amount; a substance resembling butalanin; and a crystalline matter, which appears to be the same as what Schützenberger has obtained by the action of baryta upon albumen, and which is analogous to leucin, but contains less hydrogen. By heating albumenoid bodies to 100° with pure water he obtained, *e.g.*, with gluten, syntonin, albumen, a variety of crystalline bodies, but neither fatty bodies nor urea. He announced, also, that his assistant, M. Danlos, was engaged with the products of the oxidation of albumen.

M. Gautier is resuming the study of the various proteic matters of the white of egg. He finds that albumen coagulable chiefly at 63° contains 1.7 to 1.8 per cent of sulphur; whilst that coagulating at 73° differs, not merely by its rotatory power, but also by its proportion of sulphur, which does not exceed 1.54 per cent.

M. Bourgoïn gave an account of the perbromide of acetylen and its homologues.

M. Petit describes certain experiments on fermentation which completely confirm the existence, in the leaves of fruit trees, of a mixture of reducing and non-reducing sugars. In the leaves of the vine the proportion of non-reducing sugar sometimes reaches two-thirds of the whole quantity. Determinations by Fehling's liquor, confirmed by fermentation-experiments and polarimetric observations before and after inversion, show that this non-reducing sugar is, chiefly at least, cane-sugar.

M. Henninger described M. Van't Hoff's researches on the preparation and properties of cyan-acetic acid.

Coagulation of Albumen.—M. V. Urbain.—The author, on behalf of himself and M. Mathieu, comments on an experiment of M. Gautier, laid before the Society on June 19, which, in the opinion of the latter, militates against the author's theory of the coagulation of albumen by heat. To justify such a conclusion, M. Gautier should have shown that the albumen still coagulable by heat—the result of the treatment which he indicates, no longer contained carbonic acid; this he has not done. The method which he has pursued is, M. Urbain holds, insufficient to remove the carbonic acid.

Contributions to the History of Cyan-Acetic Acid.—M. J. Van't Hoff.—The author took as his point of commencement mono-chlor-acetic ether, and by observing certain conditions, obtained almost the theoretical yield of cyan-acetic acid. It forms crystals, slightly coloured, fusible at 80°, and yielded on analysis 15.9 per cent of nitrogen, whilst the formula $\text{CH}_2\text{CNCO}_2\text{H}$ would require 16.4. It is decomposed at about 165°, giving off carbonic acid, and forming a liquid composed mainly of acetonitrile.

Observations on the Rotatory Powers of Camphor, and of certain other Bodies.—J. de Montgolfier.—This important paper does not admit of useful abstraction.

Symbols Employed to Designate the Rotatory Powers.—M. J. Ribau.—The author proposes that determinations made with the monochromatic flame of soda should be designated by the symbols α_d to express the absolute deviations, and $[\alpha]_d$ for the rotatory power, thus recalling their relation with the ray D of Fraunhofer.

Observations made with the visible tint should be as usual represented by the symbol $[\alpha]_j$.

Rectification.—M. E. Demole.—The author, referring to his paper on the preparation of glycol (*Berichte der Deutschen*, 1874, p. 641), points out that the alcohol must be used, not at 80, but at 91 per cent.

MISCELLANEOUS.

Gramme's Magneto-Electric Company.—This company has been formed to utilise for industrial purposes Gramme's Magneto-Electric Machine. Amongst the important objects which the promoters have in view are the application of the machine to the production of light, the electro-deposition of metals, and to metallurgy and chemical manufactures. Most successful experimental results have been obtained, and useful as the invention will prove for industrial purposes, it possesses still higher value from a scientific point of view, being based on new principles. The capital of the company is to be £250,000 in 25,000 shares of £10 each, 14,000 of which are now offered for subscription. The share lists will close on Thursday, February 4, for London, and Friday, February 5, for country applications.

Metropolis Gas Supply.—Dr. Letheby, the Chief Gas Examiner appointed by the Board of Trade, has recently reported to the Corporation of the City of London, and to the Metropolitan Board of Works, on the quality of the gas supplied by the Chartered, the Imperial, and the South Metropolitan gas companies during the quarter which expired on the 31st of December last. He states that the average illuminating power of the common gas of the Chartered Company at the four testing places was as follows:—At Beckton, North Woolwich, 17.46 standard sperm candles; at Cannon Street, City, 16.68 candles; at Friendly Place, Bow, 17.02 candles; and at Ladbroke Grove, Notting Hill, 16.63 candles. The illuminating power of the gas supplied by the Imperial Company averaged 16.68 candles at Carlyle Square, Chelsea; 15.63 candles at Camden Street, Camden Town; 16.58 candles at Graham Road, Dalston; and 17.36 candles at Bruce Terrace, Bow; while that of the South Metropolitan Company at Hill Street, Peckham, was 16.42 candles. The lowest illuminating power during the quarter was 15.5 candles in the case of the Chartered gas; 14.3 in that of the Imperial; and 15.3 in that of South Metropolitan. The cannel gas of the Chartered Company ranged from 20 standard candles to 22.4, the average for the whole quarter being 20.8 candles. It thus appears that the illuminating power of the gas supplied to each of the testing places has been at all times equal to the requirements of the several Acts of Parliament, viz., 16 standard sperm candles for the gas of the Chartered Company, and 14 for that of the two others. As regards purity, Dr. Letheby reports that on six occasions the gas of the Chartered Company at Ladbroke Grove was charged with sulphuretted hydrogen. The same was the case on five occasions with the gas of the Imperial Company at Bruce Terrace. The average amount of sulphur in the gas at the several places was as follows:—Beckton, 12.27 grains per 100 cubic feet; Cannon Street, 10.37; Friendly Place, 9.83; Ladbroke Grove, 17.49; Millbank, 17.68; Carlyle Square, 14.99; Camden Street, 17.34; Graham Road, 15.59; Bruce Terrace, 10.83; and Hill Street, 19.86. The proportion of this impurity was in excess of the prescribed quantity on one occasion at Camden Street, on three occasions at Bruce Terrace, and on four occasions at Hill Street, Peckham. All these have been the subjects of special enquiry; and Dr. Letheby states that the excess of impurity (sulphur and sulphuretted hydrogen) was due to accidental derangements of valves in the case of the Chartered and Imperial gas, but he was unable to find a satisfactory cause for the excess of sulphur in the gas of the South Metropolitan Company. The proportion of ammonia in the gas of the

several companies averaged 0.77 of a grain per 100 cubic feet of the gas at Beckton; 0.46 at Cannon Street; 1.11 at Friendly Place; 0.13 at Ladbroke Grove; 0.07 at Millbank; 0.47 at Camden Street; 1.19 at Hill Street; and 0.0 at Carlyle Square, Graham Road, and Bruce Terrace. The maximum amount of this impurity in the Chartered gas was 2.2 grains per 100 cubic feet; in the Imperial gas, 1.5 grains; and in the South Metropolitan, 2.4 grains. In no case, therefore, did the ammonia exceed the prescribed quantity of 2.5 grains per 100 cubic feet. Dr. Letheby concluded his report to the Metropolitan Board of Works by stating that the testings at their stations were defective on thirty-nine occasions, from causes referred to in the tables which accompanied his report.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the mode and apparatus for destroying and preventing acidity in beer. Edmund Richard Southby, analytical chemist, of Willes Road, Kentish Town, Middlesex. April 20, 1874.—No. 1361. When the beer is acid I neutralise or partially neutralise. I then heat the beer to the temperature required to destroy or render quiescent the acid ferments. For this purpose I use a closed vessel strong enough to withstand the pressure of the gases evolved, or connected with a condenser by which to save the alcohol and other volatile matters which may be returned to the beer. Within the vessel I use a coil pipe for heating by steam or hot water, and afterwards use the coil as a refrigerator by passing cold water through it; and to cause circulation in the beer I enclose the said coil in an open cylinder reaching from near the bottom of the vessel to within a few inches of the surface of the liquid. I then allow the insoluble matters to deposit, and mix the beer so treated with other sound beer, preferably with beer recently brewed and at the time of racking. Beer containing a portion so treated is found to possess extraordinary keeping qualities, and the flavour is rather improved.

Improvements in the preservation of alimentary substances. Miles Henry Smith, chemist, of Wandsworth. April 22, 1874.—No. 1394. This invention relates to the preservation of alimentary substances, such, for example, as fish, flesh, and fowl, and consists in the employment for such purposes of aldehyde either alone or in solution, or in combination with other substances and compounds having aldehyde as their base or as one of their constituents. In carrying out this invention I cause the alimentary substances to be preserved and contained in suitable vessels to be placed in or in contact with aldehyde, or with a solution of aldehyde or of such substances and compounds which may have aldehyde as their base or as one of their constituents, such solution being either in water or in any other suitable solvent of the same; and having so impregnated or immersed the alimentary substances, the vessels containing the same may be closed either hermetically or otherwise.

New or improved means or agents for disinfecting and deodorising purposes. Ernest Hart, Queen Anne Street, Marylebone, Middlesex. April 22, 1874.—No. 1398. Chloride of calcium, or magnesium, or sodium are combined with hydrochloric or other cheap acid. Or the combination is made of chloride of calcium or magnesium with a small proportion of chloride of sodium.

An improved method of and apparatus for the deodorisation and utilisation of sewage. William Robert Lake, of the firm of Haseltine, Lake, and Co., patent agents, Southampton Buildings, London. (A communication from Leopold Hesse, merchant, Melbourne, Victoria.) April 23, 1874.—No. 1415. The improved method of deodorising and utilising sewage, which forms the chief part of this invention, consists first in distilling it; and, secondly, in providing some suitable ingredient for retaining the valuable portion of the vapours given off from the boiler or retort. The apparatus in which I conduct these operations consists of an agitator working in a large reservoir, one or more boilers or retorts, and a series of Woolf's bottles to each retort.

A new process for preserving eggs by means of the carbonic anhydride and alkaline silicates. Emile Budde, doctor chemist, Auteuil, Paris. April 24, 1874.—No. 1428. The process, the subject of this invention, consists of two parts. The first is preparatory: the gases contained in the eggs are replaced by a scentless gas that cannot be respired, preferably carbonic anhydride, but carbonic acid, hydrogen, azote, or a mixture of these gases may be used. The substitution is effected by evacuation or by diffusion. To effect the first, the eggs are placed in a strong vessel perfectly closed, a vacuum is produced, and then the gas to be used is admitted. To effect the second, the eggs are placed in contact with the carbonic anhydride under ordinary pressure for, say, from twenty-four to forty-eight hours. The second part of the process has for its object to render the shell of the eggs impervious. They are steeped in a solution of silicate of soda or of potassa, and when withdrawn are left to dry, the process being then completed. In treating perfectly fresh eggs the preparatory operation is not needed, steeping them in the solution suffices.

Improvements in the manufacture and separation of certain mixed coal-tar products. Charles Lowe and John Gill, manufacturing chemists, both of Manchester, Lancaster. April 24, 1874.—No. 1435. The object of this invention is to effect and facilitate the separation of carbolic acid from the cresylic and other liquid tar acids. The nature of this invention is—(1) to submit the partially or wholly hydrated

mixtures of tar-acids above mentioned to the sufficiently prolonged action of temperatures varying between 15° F. and 56° F.; (2) to separate by suitable means the more or less hydrated carbolic acid crystals thus formed from the mother-liquors containing the liquid tar-acids and a residue of carbolic acid dissolved in them; (3) to effect complete purification of the more or less hydrated carbolic acid crystals thus obtained by re-crystallisation either by partial fusion or solution in water with subsequent refrigeration; and (4) to prepare carbolic acid of high or complete degrees of purity by dehydrating the partially or wholly purified more or less hydrated carbolic acid crystals above mentioned.

Improvements in treating guano. William George Sharp Mockford, manufacturing chemist, Old Broad Street, London. April 25, 1874.—No. 1450. This Provisional Specification describes reducing megilones or other guano to a fine state of division by grinding, and then adjusting the percentage of nitrogen by the addition of nitrate of soda, also in a state of powder, and mixing the nitrate with the guano. Or in some cases the nitrate of soda may be used in a state of solution before it has been boiled down, and crystallised, and mixed with the crude guano. The compound is then thoroughly dried in a stove, and is afterwards ground to a fine powder.

Improvements in dyeing wool and silk fabrics or materials. John Garrett Tongue, of the firm of Tongue and Birkbeck, patent agents and engineers, Southampton Buildings, Chancery Lane, Middlesex. (A communication from Ivar Bang, chemist, Paris.) April 25, 1874.—No. 1451. This invention relates to a new method of obtaining a dye upon stuffs, woollen material, and silk, this new or improved colour being called French blue, or cyanide of blue. To obtain these colours, the wool or silk is dyed in a bath containing ferricyanide of potassium, sulphuric acid, and an alum mordant, according to the usual practice; but the true colouring matter is the ferricyanide, which, under the influence of sulphuric acid, is dissolved in sulphate of potash and in ferricyanhydric acid.

A new compound of lead, applicable to the purposes for which white-lead and red-lead are employed, and the process for producing such compound from galena. Jules David, Rue Saint Anne, Paris. April 27, 1874.—No. 1454. This invention consists in producing a new substance termed "galenite" from sulphuret of lead. Galena is reduced to powder, and is oxidised at a low red-heat in open retorts, and is thus converted into a bibasic sulphate, which is then ground between mill-stones immersed in water. The liquid thus obtained is placed in vats; and the suspended matter is allowed to deposit, and is dried, and constitutes the new substance termed "galenite," which is applicable for all purposes for which red-lead and white-lead are employed.

Improvements in the manufacture of white- and red-lead and litharge. William Baker, Sheffield, York. April 28, 1874.—No. 1474. This invention for improvements in the manufacture of white-lead and of red-lead and litharge, consists in the employment of lead alloyed with a certain amount of zinc; such lead to be used for the making of red-lead litharge, or cast for corrosion in the usual manner for its exposure to the action of carbonic acid, aqueous vapour, and acetic acid, according to the usual methods of making white-lead.

MEETINGS FOR THE WEEK.

MONDAY, Feb. 1st.—Medical, 8.

— London Institution, 5.

— Society of Arts, 8. (Cantor Lectures.) "Alcohol, its Action and its Use," by Dr. B. W. Richardson, F.R.S.

— Royal Institution, 2. General Monthly Meeting.

TUESDAY, 2nd.—Civil Engineers, 8.

— Royal Institution, 3. E. Ray Lankester, M.A., "On the Pedigree of the Animal Kingdom."

— Zoological, 8.30.

WEDNESDAY, 3rd.—Microscopical, 8. (Anniversary.)

— Pharmaceutical, 8.

— Society of Arts, 8. Mr. J. A. Coleman, C.E., "The Protection of Buildings and Ships from Fire, with Arrangements for the Ventilation of Ships."

THURSDAY, 4th.—Royal, 8.30.

— Chemical, 8.

— Royal Society Club, 6.30.

— Royal Institution, 3. Professor Tyndall, "On Subjects Connected with Electricity."

FRIDAY, 5th.—Royal Institution, 8. Weekly Evening Meeting. Mr. James Dewar, "On the Physiological Action of Light," 9.

— Geologists' Association, 8. (Anniversary.)

SATURDAY, 6th.—Royal Institution, 3. Mr. J. T. Wood, "On the Discovery of the Temple of Diana, and other results of the Government Excavations at Ephesus."

UNIVERSITY COLLEGE, LONDON.

ELECTRICITY and MAGNETISM.—Professor G. C. FOSTER, F.R.S., will begin a Course of about Fifty Lectures on ELECTRICITY and MAGNETISM on Friday, 12th of February, at 4 p.m., to be continued on succeeding Mondays, Wednesdays, and Fridays at the same hour. Fee for the Course, £5 5s. Practical Instruction in the Methods of Electrical and Magnetic Measurement is given in the Physical Laboratory of the College. For further information apply to the undersigned.

JOHN ROBSON, B.A., Secretary to the Council.

THE CHEMICAL NEWS.

VOL. XXXI. No. 793.

ON ATTRACTION AND REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

(Concluded from page 45.)

74. THROUGHOUT the course of these investigations I have endeavoured to keep in my mind the possible explanations which may be given of the actions observed, and I have tried, by selecting some circumstances and excluding others, to put each hypothesis to the test of experiment. The most obvious explanation is that the movements of the beam, or of the horizontal index (69, 70), are due to the currents formed in the residual gas, which, theoretically, must be present to some extent even in those vacua which are most nearly absolute.

In favour of this explanation it may be urged that a highly rarefied gas may be much more mobile than when it is denser, and therefore the more rapid impingement of its particles, when set in ascension by warmth, would increase their mechanical action. Increased momentum may counterbalance diminished number.

That the residual gas in an air-pump vacuum is capable of exerting considerable mechanical action, may be assumed by the phenomena attending the passage of meteorites through the upper regions of the atmosphere, their friction against the air at an average height of 65 miles above the earth's surface raising them to incandescence, although at that height the attenuation of the air probably surpasses that of most artificial vacua.

On the other hand, it is most difficult to believe that the residual air in a Sprengel vacuum, where the gauge and barometer are appreciably level, can exert, when gently warmed by the finger, an upward force capable of instantly overcoming the inertia of a mass of matter weighing several grains, and setting it in motion. It must be remembered that the upward current supposed to do this is simply due to the diminished weight of a portion of the gas, caused by its increase in volume by the heat applied.

75. Another argument in favour of the air-current explanation can be drawn from the fact that when a light beam, having equal weights of pith and platinum suspended at the ends, is sealed up in a Sprengel vacuum, the application of warmth below causes the pith to rise more readily than the platinum (62); the pith obviously offers a much more extended surface than the platinum does to the impact of air-particles.

This, moreover, is not an isolated instance. Throughout the whole of these experiments the law appears to be that the force exerted is in proportion to the extent of surface exposed (48, 62, 63, 64, 65, 67) rather than in proportion to the mass. Much surface and extreme lightness are the requisites in selecting materials for the beam, index, or gravitating mass; and when the masses have the same specific gravity and extent of surface, their position in respect to the source of heat determines the extent of movement. Thus a cylinder of pith is more sensitive when arranged for the heat to act on its side than on its end; and the film of mica in experiment 65 was more affected when the heat struck its flat surface than its edge, although the difference was not so great as might have been expected had air-currents been the cause of motion.

76. But these facts can equally well be used on the opposite side; for assuming that the movement is due to

a repulsive action of radiation, it is reasonable to suppose that extended surface, weights being equal, would have an advantage. The repulsion by radiation only acts on the surface of bodies, and does not seem to act on the molecules which constitute thickness. When radiant heat gets below the surface of a body, it spends itself in doing mechanical work of another kind, viz., dilatation or expansion.

77. However strong may be the reasons in favour of the air-current explanation, they are, I think, answered irrefragably by the phenomena themselves. An air-current produced by heat can cause the beam of a balance to rise, can drive a suspended index sideways, and, by a liberal assumption of eddies and reflections, can perhaps be imagined to cause these movements to take place sometimes in the opposite directions; but as rarefaction proceeds these actions will certainly get less, and they will cease to be appreciable some time before a vacuum is attained; a point of no action or neutrality will be reached. But this neutral point should certainly be nearer a vacuum when a light body exposing much surface, such as pith, is under experiment than when the mass acted on is heavy like brass; whereas in practice the contrary obtains. Pith and thin glass balances, which should be sensitive to highly attenuated air-currents, cease to respond to heat at a rarefaction of 7 millims. (30) and 45 millims. (66), whilst brass only ceases to be affected when the gauge and the barometer are appreciably level (43).

But even could the phenomena up to neutrality be explained by air-currents, these are manifestly powerless to act after this critical point is passed. If a current of air within 7 millims. of a vacuum cannot move a piece of pith, certainly the residual air in a Sprengel vacuum should not do so; and, *a fortiori*, the residual air in a chemical vacuum could not move a piece of platinum (55).

It is, however, abundantly demonstrated that in all cases, after this critical point is reached, the repulsion by radiation is most apparent, and it increases in energy as the vacuum approaches perfection.

78. Again, the movements not only reappear on passing a particular point of atmospheric density, but they take place in the opposite direction (31, 32, 33, 44, 46, 66). Thus in all cases, when the atmospheric density is between the neutral point and a vacuum, the action of a body hotter than the moving beam or index is to repel it, whilst the action of a colder body is to attract. Now it is very probable that were it not for the interference of air-currents the action in air of greater density would always be for the hot body to attract. This is actually the case in many experiments (27, 37, 38, 40, 41, 66, 70, 72); and observations more recently made, but only alluded to in par. 72, have proved that in air of ordinary density a cold body repels.

On the supposition that air-currents are the motive power, the effects noticed when the source of heat is internal to the tube, and applied above the moving beam (37, 39, 40, 41, 45), are inexplicable, whilst they are easily comprehended on the repulsion-by-radiation hypothesis.

If an additional argument is necessary to show that air-currents are not the cause of the repellent action of a hot body, I bring forward the fact that the movement attains its maximum when there is no air at all present (54, 55, 68).

79. Effects probably due to this repulsive action of radiation are constantly met with. I will instance the following: Cohesion and adhesion are diminished by heat. This naturally follows if increased temperature augments the force of repulsion between the molecules.

The phenomenon of the spheroidal state is probably due in some measure to a repulsive force exerted between closely approximated bodies, one of which is at a very high temperature. This action is generally supposed to take place only when one of the bodies is volatile, and the rapidly formed skin of vapour is held to be a sufficient cause of non-contact. I venture to anticipate that a condition similar to the spheroidal state will be found to obtain between non-volatile bodies.

* From the *Philosophical Transactions of the Royal Society of London*, vol. clxiv., part 2.

Many finely divided chemical precipitates, when incandescent in a platinum crucible, assume a remarkable mobility and flow about like water. Precipitated silica is an instance which will occur to chemists. A space can readily be distinguished between the powder and a hot capsule containing it. Electricity may, however, play some part in this action; for precipitates, when heated, sometimes become sufficiently electrical by stirring with a glass rod to fly out of the basin containing them; oxalate of lime possesses this property in a remarkable degree.*

80. It must, however, be remembered that my experiments show the action of hot bodies in air to be that of attraction, and that the repulsion by heat only becomes evident near upon a vacuum. It is seen, therefore, that radiant light or heat has an attractive or repulsive action, according to the medium in which it acts, corresponding results being furnished by cold. There appears to be an interfering action of air other than that of the currents caused in it by heat, which masks or overcomes the true action of heat; but in a vacuum this interfering cause is absent, and radiant heat is free to exert its full repellent action, whilst cold or negative heat acts in the opposite direction. Heat and cold, heat present and heat absent—molecular activity and molecular rest—are therefore antagonistic in their action on a body free to move in empty space. The molecules of matter whose mode of motion constitutes heat are drawn together and condensed as these vibrations diminish in amplitude, whilst heat drives them apart, expanding a solid, changing a solid into a liquid and a liquid into a gas.

The masses used in my experiments are likewise repelled by heat and drawn together by cold. And it is with no weak force or feeble action that I have been dealing. It is so decided that in some of my balances the approach of a finger will completely overturn them, whilst the radiant warmth of the body affects them 6 feet off; and at higher temperatures and with larger masses the action must be still more energetic.

81. It is not unlikely that in the experiments here recorded may be found the key of some as yet unsolved problems in celestial mechanics. In the sun's radiation passing through the quasi vacuum of space we have the radial repulsive force, possessing successive propagation, required to account for the changes of form in the lighter matter of comets and nebulae; and we may learn by that action, which is rapid and apparently fitful, to find the cause in those rapid bursts which take place in the central body of our system; but until we measure the force more exactly we shall be unable to say how much influence it may have in keeping the heavenly bodies at their respective distances.

So far as repulsion is concerned, we may argue from small things to great, from pieces of pith up to heavenly bodies; and we find that repulsion shown between a cold and warm body will equally prevail, when for melting ice is substituted the cold surface of our atmospheric sea in space, for a lump of pith a celestial sphere, and for an artificial vacuum a stellar void.

Attraction being developed by radiant heat under influences connected with air, it is not easy to conceive how it will be produced for cosmical purposes by heat; the upper surface of our atmosphere must present a very cold front, and from this we might argue repulsion by the sun, unless we fill space with a body acting like air, when we should have attraction. We might readily find conditions for both, but how to harmonise them is a difficulty.

Although the force of which I have spoken is clearly not gravity solely as we know it, it is attraction developed from chemical activity, and connecting that greatest and most mysterious of all natural forces, action at a distance, with the more intelligible acts of matter. In the radiant molecular energy of solar masses may at last be found that "agent acting constantly according to certain laws" which Newton held to be the cause of gravity.

SOME POINTS IN THE CHEMISTRY OF MILK.*

By C. A. CAMERON, M.D.,
Professor of Hygiene, Royal College of Surgeons, Ireland.

Colour of Milk.

THE author states that the colour of milk is chiefly due to the reflection of light from the myriad of solid caseous capsules in which most of the fats of milk is contained. They are translucent, and (but to no great extent) refract light. In fresh milk there are globules of free fat, sometimes numerous, but rarely exceeding 0.0015" in diameter. By continued ebullition of a mixture of milk (rendered slightly alkaline with KHO) and other liquids, all, save the merest trace of fats, may be removed, leaving a perfectly milk-like liquid. Attention was called to the fact that butter-milk containing 0.5 per cent of fats was whiter than skimmed milk containing 1.3 to 2 per cent of fats. In the former the caseous envelopes of the so-called fat globules were left; from the latter a large proportion was removed, in the form of cream. From these and other facts the author concluded that the opacity and whiteness of milk were due not to the liquid being an emulsion of fats, but to the reflection and refraction of light by solid caseous matter suspended in it.

Cow's Milk.

The results of several thousand analyses of cow's milk made by the author, since 1865, led him to conclude that the mixed milk of town cows never contained less than 12, and that of country cows 11.5, per cent of solids; and he agreed with Prof. Wanklyn that the solids, minus fats, never sank below 11.3 per cent. Several hundreds of convictions for selling adulterated milk occurred in Dublin, and though in many cases the alleged amount of adulteration with water was only 12 per cent—and in each case a duplicate sample was produced in Court—the accused never elected to have it re-examined, though on other points barristers and solicitors constantly raised issues. Forty analyses of pure milk from Dublin dairy cows gave the following average results:—

Water	87.00
Fats	4.00
Albumenoids.. .. .	4.10
Sugar	4.28
Mineral matter	0.62
	100.00

Mare's Milk.

Gorup-Besanez, in page 416 of the second edition of his "Lehrbuch der Physiologischen Chemie," states that mare's milk contains 17.163 per cent of solids, including 6.872 per cent of fats. Clemm found it rich in solids, and to contain nearly 7 per cent of fats. Simon, in his "Physiological Chemistry," states it to be very rich in solids. It is probable that the milk analysed by these chemists could not have been that of the mare, which, being akin to the ass, would be likely to yield, like the latter, a milk poor in solids, and poorer still in fats. The author examined the milk of fourteen mares, and found the solids to vary from 8.5 to 11.5 per cent, the fats from 0.6 to 2.12, the casein from 1.46 to 2.4, the sugar from 5.67 to 6.87, and mineral matter from 0.33 to 0.44 per cent. The average of the fourteen specimens gave—

Water	90.310
Fats	1.055
Albumenoids	1.953
Sugar	6.285
Mineral matters.. .. .	0.397
	100.000

Mare's milk is bluish-white; sp. gr. about 1.031; reaction neutral, or faintly alkaline.

* Faraday's "Experimental Researches in Electricity," vol. ii., p. 163.

* Abstract of a paper read before the Royal Dublin Society, January 18, 1875.

Sow's Milk.

The sow parts with its milk (except to its young) with great reluctance. Its sp. gr. is 1.041; its reaction faintly alkaline, and colour yellowish white: 100 parts contain (mean of two analyses)—

Water	81.760
Fats	5.830
Albumenoids	6.180
Sugar	5.335
Mineral matters	0.895

100.000

These results show this species of milk to be very rich. It is remarkable that in the lactometer it shows up no cream. Drying on the water-bath it exhales the odour of roast pork, and on putrefying that of putrid bacon.

LABORATORY NOTES.

LIMIT OF WEIGHING; CONDENSATION OF AIR ON SURFACE OF PLATINUM; GOLD-LINED CAPSULES; WEIGHING ON FILTERS; READY METHOD OF SHOWING ABSORPTION OF HYDROGEN BY PALLADIUM.

By J. LAWRENCE SMITH,
Of Louisville, Kentucky.

The Limit of Weighing.

IN quantitative analyses there is, perhaps, no one part in the process on which more time is needlessly lost than at the balance. While a chemist should not consider any time lost which is needed for accuracy of results, yet he need not consume time attempting what is called accuracy of weighing far beyond the limit of error of the circumstances under which a balance in the laboratory, with the containing vessels of platinum, glass, and porcelain (used to contain the materials weighed) is placed. Some of our most accurate and distinguished analytical chemists, as Rose and others, we are informed, only weighed within 1 m.grm., using 1 to 2 grms. of the material; in my own practice, using from 0.500 to 1 grm., I consider it useless to weigh nearer than $\frac{1}{2}$ m.grm. A little practice will soon enable any one to judge where to place the last $\frac{1}{2}$ m.grm.

My remarks thus far apply to the great run of accurate chemical analyses. When it comes to the more precise study of atomic weights, I still adhere to the limit of $\frac{1}{2}$ m.grm., but increase the amount of material experimented with.

In regard to assay analyses of gold and silver, of course these rules are not meant to apply, for there we have a special balance whose beam is no larger than a wire, and whose entire range is very small, and therefore can be kept to an adjustment far exceeding anything that can be done with analytical balances of the most approved make.

Condensation of Air on the Surface of Platinum.

In connection with the subject of weighing, I would add the following observations of mine on platinum vessels.

After taking the weight of a clean platinum vessel, then wiping it thoroughly with a dry rag or soft paper, and replacing it on the pan of the balance, it will be found to have lost weight; if of the ordinary size used in quantitative analysis, it will be found to have lost 2 m.grms. or more. If allowed to remain on the balance for fifteen or twenty minutes, it will be found to have recovered its weight. This change has usually been attributed to moisture, but I have clearly established that this is not the case. The following is the result of some accurate experiments:—

A new flat-bottom capsule, 4 centimetres in diameter and 2 centimetres deep, having about 50 centimetres square of surface inside and outside, was first thoroughly cleaned by boiling in a solution of caustic soda. After thorough washing in distilled water, it was heated to redness, allowed to cool, and in one hour weighed. It was now taken from the balance and wiped with clean filter-paper, taking care to touch, as far as possible, all parts of

the surface, without using any violent friction. After being submitted to this operation it was replaced on the balance, and it was ascertained to have lost 2 m.grms., and after being allowed to remain for twenty minutes its original weight was restored.

The vessel was now transferred to a drying receiver over sulphuric acid, and allowed to remain six hours; placed on the balance, it weighed exactly what it did when placed in the drying receiver. It was now wiped as before, and on being replaced on the balance had lost 2 m.grms., which it recovered, as before, in fifteen or twenty minutes.

The vessel was now transferred to a receiver in which the air was saturated with moisture from wet paper, placed on the glass support. After six hours the capsule was placed in the balance, when it was found to weigh just the same as it did when it was introduced into the moist atmosphere. A dry atmosphere or a moist atmosphere was then shown to have no effect in producing this temporary loss of weight in the capsule.

From these experiments, it shows very clearly that there is air condensed on the surface of platinum that a little rubbing will remove; but it will soon return to the platinum after this treatment. The importance of this fact will be manifest to the analytical chemist, and make him cautious about taking the tare of his platinum vessels too soon after wiping them.

Gold-Lined Capsules and Crucibles.

While the analytical chemist cannot always indulge in every form of luxury of apparatus which might tend to facilitate and give precision to his researches, still they are very convenient and useful at times. Those who have had much to do with caustic potash and nitre heated to redness, know that silver vessels will not always answer their purpose. Under these circumstances gold vessels are very useful, but very expensive, and I have for some time been using what might be called a compromise vessel, made of platinum lined with gold; not platinum gilt, but made in the following manner:—A thick sheet of platinum is taken and the requisite amount of gold melted on the surface, the whole is then rolled out to the proper thickness for capsules and crucibles, and these latter vessels then made out of this sheet. There was some little difficulty attending the making of the first vessels, but this was entirely overcome in the establishment of Johnson, Matthey, and Co., Hatton Garden, London, where the vessels I use are made.

Weighing on Filters.

In weighing precipitates on the filter, the common method I employ is to take two filters of the size required, which have been cut to size together. These filters are placed on the balance and weighted one against the other. Ordinarily there will be but a few m.grms. difference in weight, which difference is marked in small numbers with pencil on the heavier. These filters are placed on the funnel side by side, the substance to be filtered is poured on one, and the filtrate from the first is poured on to the second filter, and so with the washings. When the filtration and washing are complete, the two filters are placed on the warm bath and dried; the weighing being conducted in the ordinary way, only the empty filter is placed on the balance as a tare to the other, and due allowance made for the excess of weight of one filter over the other in taking account of the weight of the substance. This has some advantages over the ordinary way with the filter, as there is no need of any special precaution of washing the filter prior to use in any way, or drying in a glass tube, and using any precaution against the hygroscopic moisture that is likely to be absorbed by the dry filter, for there is always a filter on each side of the scale subject to like conditions. It enables me at least to dispatch my work more readily and satisfactorily.

A Ready Method of showing the Absorption of Hydrogen by Palladium.

In the beautiful and important investigations of Graham upon the absorption of hydrogen by palladium, he described

a very pretty method of making this absorption very apparent to the eye, viz., to take a strip of thin palladium, place wax or other non-conducting and pliable substance on one surface of the strip, and then attach it to the proper pole of a galvanic battery, and plunge it into water acidulated with sulphuric acid, when the hydrogen that is evolved at that pole, instead of escaping as gas, is absorbed by the palladium, which now bends and coils up on itself in virtue of the expansion on the exposed side.

This same result I have been in the habit of exhibiting in my laboratory, with a small piece of very thin palladium, about $1\frac{1}{2}$ centimetres wide and 8 centimetres long. Light a small-sized Bunsen burner, hold the piece of palladium in the upper part of the flame; it will get red-hot, but remain in the same form as when introduced in the flame. Lower it now into the flame, until the unburnt gas from the centre of the flame strikes the bottom of the metal, when it will immediately coil upwards, and can be made to double on itself. Carry it back to the upper part of the flame and it will straighten itself again. There are some interesting chemical questions connected with this experiment that are worth working out, and at some leisure moment I will look into them; as, for instance, the absorption of the gas at this high temperature, and as to whether or not simply hydrogen is absorbed, the palladium thereby decomposing the hydrocarbon, &c.

THE PRODUCTION OF ANILINE COLOURS WITHOUT THE USE OF ARSENIC ACID.

It will be within the remembrance of readers of the CHEMICAL NEWS that Coupier, of Paris, was the first to succeed in producing fuchsine by the action, at a suitable temperature, of hydrochloric acid and iron in small quantities on pure aniline and nitrotoluol. Though Coupier's experiments were confirmed by Schützenberger, who showed the aniline-red obtained by Coupier's process to be identical with that usually manufactured, and found the yield somewhat greater than that obtained by the use of arsenic acid, the process was not applied industrially before 1872, when Meister Lucius, and Brüning, of Hoechst, Germany, succeeded in working it on a large scale. This firm, however, appear to manufacture their colours only in part by this method, as they still supply the market with dyes containing arsenic.

More recently, the Gesellschaft für Anilin Fabrikation, of Berlin, have erected new works, where no arsenic acid is used in the preparation of colours. Not only fuchsine (rubine), but all the colours derived from it which are manufactured by this company are warranted to be produced without the employment of arsenic, and to be entirely free from this poisonous reagent.

The Berlin Company are working Coupier's process with several important modifications, and produce from 200 to 300 kilogs. of fuchsine per diem. Some specimens of fuchsine and other colours manufactured by this Company appear to be products of unrivalled beauty, purity, and strength. The fuchsine is stated to be not only purer, but stronger than that made by the aid of arsenic acid, and is the pure hydrochlorate of rosaniline. The rosaniline base, from its great purity, is admirably adapted for the preparation of aniline blue, and is largely used by other manufacturers of aniline colours.

Being free from arsenic, these dyes are not only fitted for colouring sweetmeats, liqueurs, syrups, and pharmaceutical preparations of every description, but may be used in many other industrial purposes where poisonous colours would be more or less dangerous, as in the staining of paper, paper-hangings, toys, &c.

It is to be desired that other manufacturers of these dyes will adopt the new method, and relinquish the old arsenic acid process, which, apart from the inconveniences it has caused both manufacturers and consumers, has led to many lamentable accidents.

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Annual Meeting, 1874.

E. W. BINNEY, F.R.S., F.G.S., Vice-President, in the
Chair.

THE Report of the Council was read, from which we extract the following:—

Dr. Frederick Crace-Calvert, F.R.S., was born near London, on the 14th of November, 1819.

In the year 1835, when 16 years of age, he left London and went to France, where he commenced the study of Chemistry under the celebrated chemist Gerardin, at Rouen, and continued with him for two years. At the expiration of this time he went to Paris, and carried on his studies at the Jardin des Plantes, the Sorbonne, Collège de France, and Ecole de Médecine, his attention being principally given to the Natural Sciences.

About the age of 21 he was appointed to manage the well-known works of Messrs. Robiquet and Pelletici, where the manufacture of pure chemicals and pharmaceutical products is carried on. This position, however, he soon vacated, on being offered that of "Démonstrateur de Chimie Appliquée," under the eminent chemist Chevreul, and here he remained from 1841 till 1846, when he left France. From the former date his career as a chemist began, and continued with untiring energy during the succeeding thirty-two years.

He published his first paper, "Sur l'Extraction de Quinine et Cinchonine," in September, 1841.

In 1843, in conjunction with M. Ferrand, he elaborated an interesting paper on the analysis of gases enclosed in some organs of plants, the gases being taken from the same plants at different times of the day and year, to demonstrate the action of the sun's rays. This paper is entitled "Memoire sur la Végétation, and may be found in vol. v. of the *Comptes Rendus*. In the following year the diseases of beer engaged his attention, and some interesting facts were embodied by him in a paper read to the Société de Pharmacie, "Sur la Fermentation visqueuse de la Bière."

From 1843 till the time of his leaving France he was engaged in a research on some compounds of lead, which first brought him into note. One of the papers consequent on this may be found in the *Comptes Rendus* of 1843, entitled "Procédé au moyen duquel on obtient un Protoxyde de Plomb cristallisé at ayant la Couleur du Minium."

In 1844 he wrote "On the Presence of Indigo in the Orchidaceous Plants;" in 1846, "On the Preparation of Calomel on the Large Scale;" and, in the same year, a compilation of facts relating to the properties of animal-black.

On returning to England, at the latter end of 1846, he was first appointed to the chair of the honorary professorship of chemistry at the Royal Institution, and afterwards to that of lecturer on chemistry at the School of Medicine in Pine Street, Manchester.

In 1847 he published a paper "On Bleaching Powders," and in 1848 one "On the Bleaching of Cotton and Flax."

About this time Dr. Calvert gave a long series of lectures on his favourite subject, at the Athenæum, Manchester, "The Application of Chemistry to Manufactures." These were recorded in the daily papers.

During the following years many other subjects engaged his attention, but we may notice the following publications as some of the results of his labours:—

In 1849, "Process for the Preparation of Chlorates, particularly the Chlorate of Potash."

In 1851, "On the Oxides and Nitrates of Lead."

In 1854, "A case of Poisoning by the Sulphate of the Protoxide of Iron."

In 1855, "On the Adulteration of Tobacco."—"On the Action of Organic Acids on Cotton and Flax Fibres."—"On the Actions of Gallic and Tannic Acids in Dyeing and Tanning."

In 1856, "On the Solubility of Sulphate of Baryta in Different Acids."—"On the Purification of Polluted Streams."

About this time he commenced an enquiry, in conjunction with Mr. Richard Johnson, on the physical and chemical properties of different alloys. The publications resulting from these investigations were—

In 1858, "On the Hardness of Metals and Alloys."—"On the Conductibility of Metals and Alloys."—"On the Chemical Changes which Pig-Iron undergoes in its Conversion into Wrought-Iron."

In 1861, a series of papers "On the Expansion of Metals and Alloys."

In 1862, "On the Composition of a Carbonaceous Substance existing in Grey Cast-Iron."—"On the Employment of Galvanised Iron for Armour-Plated Ships."—"On the Conductibility of Heat by Amalgams."

In 1863, "On the Preservation of Iron-Plated and other Ships."

The interest he took in the preservation of ships from the action of sea-water never ceased; many unrecorded experiments were carried on by him at intervals on this subject till the last days of his life.

In 1865 Mr. Richard Johnson and he published "On the Action of Sea-Water on certain Metals and Alloys," and in 1866 "On the Action of Acids on Metals and Alloys."

In 1870 two papers appeared by Dr. Calvert; one "On the Composition of Iron Rust," the other "On the Oxidation of Iron;" and a third on the same subject in 1871.

In 1858 we find a publication of his "On a New Method of preparing Hydrochloric Acid."

In 1859, "On the Analyses of Wheaten Flours."—"Influence of Science on the Arts of Calico-Printing."—"On Starches: the Purposes to which they are Applied, and Improvements in their Manufacture."

During this year his attention was called by the late Dr. Ransome to hospital gangrene, and in seeking its cause he was led to investigate the compounds produced during putrefaction.

Two papers, descriptive of his results, appeared in 1860; the first "On Products of Putrefaction," the second "On New Volatile Alkaloids given off during Putrefaction."

He continued, during the following two or three years, with these researches, and had collected about an ounce of a precipitate, produced by combining the gaseous products of putrefaction with platinum, by passing the gases emitted by the putrefying meat through bichloride of platinum, by means of aspirators, during many months. This accumulation of precipitate was unfortunately destroyed before its examination could be completed, through the carelessness of one of his assistants, which caused him much regret ever afterwards.

In 1861 he wrote "On Improvements in the Manufacture of Colouring Matters," and "On the Chemical Composition of Steel." A report followed "On the Action of Water supplied by the Manchester Corporation on Lead of different kinds," in connection with the Manchester Sanitary Association.

In 1862 he gave a series of lectures to the Society of Arts, "On the Improvements and Progress in Dyeing and Calico-Printing since 1851;" in 1864, "On Chemistry as applied to the Arts;" in 1866, "On Discoveries in Agricultural Chemistry," and "On Discoveries in the Chemistry of Rocks and Minerals." These were the beginning of the Cantor lectures, which are now continued every year by different lecturers.

In this same year we find another paper by him "On Wood for Ship-building."

In 1863 he patented and worked at his process for the separation of sulphur from coke, by use of common salt, for the purpose of the manufacture of iron of superior quality.

The following is a list of some of his further publications—

In 1865, "On the Action of Silicate and Carbonate of Soda upon Cotton Fibres."—"On the Crystallised Hydrate of Phenic Alcohol."

In 1866, "On the Hydraulicity of Magnesians Limestone."—"On the Preparation of Acetylene."

About this time he interested himself with the properties of phenic or carbolic acid, and, being satisfied of its valuable disinfecting properties, built works for its manufacture, and to him belongs the honour of having first brought it in a pure state into commerce.

In 1867 he wrote papers "On Oxidation by means of Charcoal," "On the Presence of Soluble Phosphates in Cotton Fibres, Wheat, and other Seeds," and five articles "On the Synthesis of Organic Substances."

In 1867, "Carbolic or Phenic Acid and its Properties" (three articles).

In 1869, "Presence of Soluble Phosphates in Seeds."—"Preparation of Nitrogen."

In 1870, "Testing Petroleum."

In 1872, "Sulphur in Coal and Coke;" and papers on "Protoplasmic Life," "Vitality of Disease Germs," &c. Part of the latter series remains yet unpublished.

In concluding the list of Dr. Crace-Calvert's various researches, we may mention that, besides the above, many others were made by him, but their unfinished state does not justify publication. Among these may be mentioned one on "Light," which cost him much labour, and one "On the Action of Different Gases on each other under Enormous Pressures."

He was a Fellow of the Royal Society, of the Chemical Society, and of many other Societies both at home and abroad.

Dr. Calvert showed remarkable devotion to the science he studied, and his knowledge of its literature was such as very few have attained, and such also as could only be obtained by a most unusual amount of reading, accompanied with strong interest, and in all probability much pleasure. He showed this knowledge more in the departments referring to industry, and, as might be expected, he intended to give his experience to the public in a more convenient form than his lectures presented. One of these works, that relating to "Colours other than Aniline," was nearly completed—if not entirely so—before his last illness, and is expected to be published shortly. Whilst rather exhausted with this work, added to the attention required for the manufactures in which he was engaged, he was chosen as one of the jury of the Vienna Exhibition. The summer of 1873 was sultry and unpleasant, and other causes may have operated to make it unhealthy; but whatever the reason or combination of reasons may have been (and we cannot doubt that work and anxiety contributed), the result was that Dr. Calvert returned in a very enfeebled state, and a few days after his arrival in Manchester was seized with a fatal illness, which terminated on the 24th of October of the same year.

He was a firmly built man, of middle height, and apparently of unusual strength. His hair was dark, and he seemed to be younger in constitution than his years indicated. His manner was animated, and he had great pleasure in communicating information. It is not attempted in this notice to say to what extent his writings have contributed to the advance of science or the knowledge of manufactures, but in the latter department it is certain his influence was widely felt, and his friendly disposition enabled him to become a frequent medium of communication between scientific men in England and in France, in both of which countries he felt equally at home. With these combined characteristics the position he made for himself was peculiar, and of its importance we may judge partly by the fact that, although one to which many would be glad to attain, it is not yet filled up.

PROCEEDINGS
OF THE
SOCIETY OF PUBLIC ANALYSTS.

IN pursuance of an arrangement with the Editor of the CHEMICAL NEWS, a certain space in this Journal will henceforward be devoted to the interests of the above Society.

That the Public Analysts of the United Kingdom have formed an Association is probably pretty generally known already to the chemical world; but as this is our first appearance in a literary form it becomes us, in this place, to justify our existence.

With this view we propose to lay before our readers, as succinctly as may be, the history of our origin, and an explanation of the objects we have in view.

As long ago as 1860, the attention of Parliament was directed (mainly as the result of the extensive and valuable researches of Dr. Hassall and others) to the question of the adulteration of food, and a Bill for the repression of such adulteration—at that time very widely spread—was passed.

This Bill, however, from the defective machinery arranged for carrying out its object, was practically inoperative, and in 1872 the subject again called for and received the attention of the Legislature.

The Act of 1872—though a great improvement on the previous measure, and though it has admittedly been the means of checking, in a very great degree, the evil which it was its object to prevent—has not been successful to the extent that was hoped and expected. This has arisen from various causes, among which we may mention that the Bill was drawn by gentlemen who were but imperfectly acquainted with the subject; that it has been only very partially put into operation; that the number of chemists, alike able and willing to undertake the new duties required, was, at the time of its enactment, extremely limited; and that, from the loose wording of some of its clauses, the decisions of magistrates have frequently not been in accord one with another.

Besides this, it must be remembered that the tradesmen likely to be affected by an "Adulteration Act" form, in the aggregate, an enormous, wealthy, and influential body, and having, by a long immunity, acquired more or less lax ideas of what should be considered purity and what adulteration (though we do not mean to imply that they were less honest than their neighbours who were unaffected by the Act), they very naturally resented any interference with their "vested interests;" and "vested interests" being in England uncommonly awkward things to meddle with, it is no matter for surprise that they obtained considerable sympathy from the general public, who, with wonderful unselfishness and self-abnegation, consented to swallow chicoried coffee, alumed bread, and watered milk, rather than that the grocer, the baker, or the milk-seller should be subjected to what appeared to them like oppression.

The complaints of the tradesmen, and the defects in the Bill itself, which daily became more apparent, at length led—as will be in the recollection of our readers—to the appointment, during the last Session of Parliament, of a Select Committee of the House of Commons, to enquire into the working of the Act, with a view to its amendment. Mr. Clare Sewell Read, the Secretary of the Local Government Board, very ably presided over the deliberations of the Committee; and after numerous witnesses had been examined, the Committee issued a Report, which, together with the detailed evidence given before them, forms a Blue Book of more than 400 pages.

It is not our intention here either to animadvert upon the constitution of the Committee or to criticise any of the statements made before them. Suffice it to say that three things were made manifest:—

First. That further legislation is probable, and this by itself pointed to the desirability of concerted action on the part of Public Analysts.

Second. That the representatives of each trade, though approving of the repression of adulteration in the abstract, held that their particular business should be exempted from the operation of any Adulteration Act,—so that if each section of trade was to be conciliated, no Adulteration Act whatever could be passed.

Third. That, partly through ignorance and partly through prejudice, statements were made which the Public Analysts considered to reflect very unjustly on their ability and procedure.

It will thus, we think, be admitted that sufficient cause existed for the formation of our Society; and after a preliminary meeting of some half dozen Public Analysts, a general meeting of the whole body was convened by circular, and by notices in this and in other scientific journals, and was held on August 7th at the Cannon Street Hotel. This meeting was very numerous, the subjects which called it together were fully discussed, and a number of resolutions—embodying the collective opinions of the gentlemen present—were passed.

It was decided that a "Society of Public Analysts" be formed, and a Committee was appointed to undertake the initial work connected with its formation, and to draw up a definition of "an adulterated article" (which definition we print in another column). After a number of conferences the Committee completed their allotted task, and laid the results before a general meeting, held on the 1st of December last. At this meeting a Report, submitted by the Committee, was adopted, the definition—with some slight alterations—was accepted, and a Council of the Society was elected by ballot.

As we purpose on a future occasion to recur to the subject of the definition, we will only remark here that—though it appears very simple, and might be thought to have involved but little trouble in its drawing up—the work really was an onerous one, and it was only after many conferences, and after obtaining the best assistance available, both legal and chemical, that the definition was finally drafted. It is perhaps needless to say more.

It will be understood that we shall carefully watch the introduction of the Bill promised in the coming Session, willingly supply any information we possess, and generally—as far as we may have the opportunity—"educate" our legislators on a question to which, up to now, it would be only affectation to assume that they have devoted much attention.

We have thus far only spoken of the immediate and temporary objects of the Society, but in its wider scope it will seek to embrace a mutual interchange of opinion amongst its members, a nearer uniformity of processes and results, a wider dissemination of new researches, and in every way to raise the standard of analytical work, more especially as bearing on the analysis of articles of food and drink.

Having thus, we hope, clearly defined our objects, it is, we trust, unnecessary to say that this Society does not wish to put itself in any way or degree in competition with, or to endeavour to rival, the Chemical Society, to which most of our members also belong.

As by the constitution of "The Society of Public Analysts" *all analytical chemists, but no others*, are eligible for membership, it is evident that our work, as compared with that of the Chemical Society, is very circumscribed, as we travel in a smaller circle, confining our attention to practical analyses, and leaving the more ambitious field of theoretical and speculative research to the older Society.

SOCIETY OF PUBLIC ANALYSTS.

Council of the Society.

President.—T. Redwood, Ph.D.

Vice-Presidents.—A. H. Hassall, M.D.; J. A. Wanklyn, M.R.C.S.

Treasurer.—T. Stevenson, M.D.

Other Members of Council.—Alfred H. Allen; Albert J.

Bernays, Ph.D.; C. Estcourt; G. A. Rogers, M.R.C.S.; Francis Sutton; J. W. Tripe, M.D.

Hon. Secretaries.—C. Heisch; G. W. Wigner.

Definition of an Adulterated Article.

An article shall be deemed to be adulterated—

A. In the case of food or drink:—

1. If it contain any ingredient which may render such article injurious to the health of a consumer.
2. If it contain any substance that sensibly increases its weight, bulk, or strength, or gives it a fictitious value, unless the amount of such substance present be due to circumstances necessarily appertaining to its collection or manufacture, or be necessary for its preservation, or unless the presence thereof be acknowledged at the time of sale.
3. If any important constituent has been wholly or in part abstracted or omitted, unless acknowledgment of such abstraction or omission be made at the time of sale.
4. If it be an imitation of, or be sold under the name of, another article.

B. In the case of drugs:—

1. If when retailed for medicinal purposes under a name recognised in the British Pharmacopœia it be not equal in strength and purity to the standard laid down in that work.
2. If when sold under a name not recognised in the British Pharmacopœia it differ materially from the standard laid down in approved works on *Materia Medica*, or the professed standard under which it is sold.

Limits.

The following shall be deemed limits for the respective articles referred to:—

Milk shall contain not less than 9.0 per cent, by weight, of milk solids not fat, and not less than 2.5 per cent of butter-fat.

Skim Milk shall contain not less than 9.0 per cent, by weight, of milk solids not fat.

Butter shall contain not less than 80.0 per cent of butter-fat.

Tea shall not contain more than 8.0 per cent of mineral matter, calculated on the tea dried at 100° C., of which at least 3.0 per cent shall be soluble in water, and the tea *as sold* shall yield at least 30.0 per cent of extract.

Cocoa shall contain at least 20 per cent of cocoa-fat.

Vinegar shall contain not less than 3.0 per cent of acetic acid.

NOTICES OF BOOKS.

A Course of Qualitative Chemical Analysis. By W. G. VALENTIN, F.C.S., Principal Demonstrator of Practical Chemistry in the Royal School of Mines and Science Training Schools, South Kensington. Third edition. London: J. and A. Churchill. 1874.

THE former editions of Professor Valentin's work are of such recent publication, and have been so extensively used, that our readers will scarcely be ignorant of the general arrangement and scope of the book under notice. Primarily intended for the use of students who have attended Dr. Frankland's systematic lectures on chemistry, Professor Valentin naturally employs the peculiar structural formulæ which the chemists of Dr. Frankland's school especially affect. It is not every chemist, perhaps, who would feel very sure about the composition of a precipitate expressed by the formula " $P_2O(TiO_4)^{IV}TiO^{IV}$," and it is, therefore, fortunate that the author has in this case given the alternative formula, " $2TiO_2, P_2O_5$," a plan he would have done well to follow in some other cases.

The new edition presents a great advance upon the two former, in the addition of an exceedingly complete and

well-arranged description of the reactions and natural sources of *all* the rare metals. We have before now expressed our opinion that the less common elements were inexcusably neglected, and hail with great satisfaction their introduction into what must be considered one of our leading works on qualitative analysis. Professor Valentin has not made the usual systematic course of analysis unnecessarily complicated by the incorporation in it of the rarer metals, but he gives abundant information for the intelligent student to detect them if present. The great improvement now introduced makes us hope for still further extension in the future. That the organic portion of almost all our works on qualitative analysis should be confined to the enumeration of some few of the organic acids, is a reflection on the present state of our methods, and, though it may not be possible to give the student concise directions for the recognition of even the commoner organic bodies when in admixture, a course of instruction in practical chemistry can scarcely be considered complete if it does not include the recognition of such common and well-defined bodies as alcohol, glycerine, sugar, and carbonic acid, when occurring unmixed and in a state of purity.

The recent proposal of the Parliamentary Committee to cause candidates for the position of Public Analysts to pass an examination at South Kensington, has made chemists curious to know the special qualifications of the authorities for holding examinations on food analysis, or for giving systematic instruction on the subject. Certainly there is nothing in the book under review calculated to remove the objections nearly universally felt, to submit to be examined in such a very exceptional and special department of applied chemistry as is food analysis.

We have observed with much pleasure the introduction by the author of various hints and remarks of considerable practical value, and we need hardly say that, in the departments of chemistry treated of, the information given is of unexceptional character, and conveyed in a very lucid and agreeable manner. We cannot but regret the omission of some of the more delicate special tests for the metals, &c., which, though seldom used, are sometimes of extreme value.

In addition to the detailed description of the methods of detecting and separating the various metals and salt radicals, there are also very complete tables for systematic analysis, and we are pleased to learn from the preface that these are now published in a separate and less destructible form, being printed on parchment-paper.

The Retrospect of Medicine. Edited by W. BRAITHWAITE, M.D., and JAMES BRAITHWAITE, M.D. Vol. lxx., July to December, 1874. London: Simpkin, Marshall, and Co.

THIS work, though rich in matter of the highest interest to the medical practitioner, presents little of chemical importance. The celebrated discussion on the alleged epidemic of typhoid in Marylebone, and its connection with milk, is not yet at an end. We certainly agree so far with Mr. Smee and his adherents, that we think the effects of milk given by cows fed upon sewage-irrigation farms, and no less vegetables manured with sewage, require careful watching.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 1, January 4, 1875.

Note on Magnetism; in reference to a Recent Communication of M. Lallemand.—Th. du Moncel.—

The author gives a fresh account of his experiments on magnetic condensation, which, from M. Lallemand's paper of October 19, 1874, he concludes are still not thoroughly known.

Decomposition and Preservation of Wood.—M. Max Paulet.—The author purposes to give an account of the destructive action which takes place in wooden railway sleepers injected with sulphate of copper. It is generally admitted that the protective action of the metallic salt is due to its combination with the ligneous tissue, and especially with the nitrogenous matter, which becomes insoluble and poisonous to living beings. This explanation is insufficient. The author has studied the action of metallic salts, and especially of sulphate of copper, upon the nitrogenous matter of wood, and finds that the albumino-cupric precipitate is not absolutely insoluble in water, and that it is especially soluble in water charged with carbonic acid. The nitrogenised matter in wood is partly soluble and partly insoluble. The soluble albuminous portion is fixed by the metallic salt, which combines also with the insoluble nitrogenous matter. The water, especially if charged with carbonic acid, dissolves and removes the metallic compound. Recent observations, however, have satisfied the author that the reactions are not always so simple. A sleeper of beech-wood, for example, saturated with cupric sulphate after having been buried in the ballast of a railway for eight or ten years, is found to be decayed in several parts. The portions affected are very brown in the vicinity of the rail. The wood is not worm-eaten, but it is chemically altered. If it no longer contains copper it contains quantities, often enormous, of iron furnished by the rail. This abundance of iron does not prevent the alteration of the timber. It has penetrated into the wood in a state of solution, since it has travelled far from the point of contact. Portions of wood which were in immediate contact with the iron, or which contained chinks into which scales of oxide of iron might have fallen, were of course set aside as not decisive. This precaution having been taken, it was established that in the layers of wood near the rail the woody fibre was brown, soft, brittle, and readily pulverised. The density of the wood was singularly diminished. Parts of the wood not attacked had the specific gravity 0.755, whilst the affected parts had fallen to 0.380. The affected wood still contains nitrogenous matter. It was entirely soluble in caustic potash, like ulmic acid. If treated with water acidulated with nitric acid it gives up to the solvent the lime which it contains, and a large amount of iron. This iron, although it must have been in a soluble state when it entered the wood, has become insoluble. Hence, ferrocyanide of potassium, applied to a ferruginous portion of this ferruginous wood does not produce a blue colouration. At the same time that nitric acid removes the iron contained in the modified wood it produces an evolution of carbonic acid, as if from an impure carbonate. This quantity of carbonic acid far exceeds what is found in wood decayed in the air. One-fourth of a gramme of the modified wood has yielded 10.5 c.c. of carbonic acid. This modified wood contains 3 per cent of ash, whilst normal beech-wood contains less than the half of this amount. Whilst boiling in the acidulated water a part of the wood dissolves. When the solution is concentrated in a platinum capsule, the residue blackens and carbonises. The parts of the sleeper more remote from the rail are less ferruginous, except in cases where the ballast is surcharged with oxides of iron; but carbonate of lime is very abundant in the affected parts. The copper gradually passes out of combination, and disappears altogether, giving place to the carbonate of lime. The process is as follows:—The carbonate of lime contained in the ballast becomes soluble in an excess of carbonic acid, penetrates gradually into the wood, and substitutes the copper. Hence, to determine the degree of the change undergone by the wood, it is sufficient to determine the quantity of carbonic acid or of carbonates present. The tenacity of the woody fibre is inversely as the carbonic acid present.

As long as the copper remains in its original combination its preservative action continues. The carbonate of lime is not a septic agent, but it eliminates the preservative body from its compounds, and restores the matter to be preserved, if not to its natural state, at least to one which facilitates the access and the action of destructive agents. This confirms and explains the fact, already established by observation, that sleepers are decomposed most rapidly in calcareous soils.

Germination of Chevallier Barley.—M. A. Leclerc.—The object of this memoir is to show that when grains germinate in a limited space there does not take place, as MM. Dehérain and Landrin announced (*Comptes Rendus*, lxxviii., p. 1488), an occlusion of nitrogen gas at the outset of germination; and that the final augmentation of the nitrogen gas in experiments of long duration is due to a partial decomposition of the grain.

Letter on the Phylloxera.—M. L. Roesler.

Expression of Work Relative to an Elementary Transformation.—M. J. Moutier.—A mathematical paper; not suitable for abstraction.

Analogies between the Escape of Gases from Supersaturated Solutions, and the Decomposition of Certain Explosives.—M. D. Gernez.—The author concludes from his experiments that there is the strongest analogy between the escape of a dissolved gas, taking place on the surface of the solution into a gaseous medium, into which the gas passes as into a rarefied atmosphere, and that decomposition of explosives which cannot, as in the case of oxygenated water, be ascribed to a particular catalytic force.

Atomic Structure of the Molecules of Benzene and Terebene.—G. Hinrichs.—This paper requires the accompanying diagrams. The author refers to his work, "Principles of Chemistry and Molecular Mechanics." Davenport: Iowa, U.S.

Titanic Ethers.—M. E. Demarçay.—Of all the titanic ethers, the only one hitherto known is the trichlorhydrin, $\text{TiCl}_3\text{OC}_2\text{H}_5$. The author has produced the hydrochlorate of monochlorhydrin, $\text{Ti}(\text{OC}_2\text{H}_5)_3\text{Cl}, \text{HCl}$.

Pyruvic Ureides; Condensed Ureides.—M. E. Grimaux.—This paper treats of dipyruvic-triureide, tetrapyruvic-triureide, and dipyruvic-tetraureide.

Aërial Corpuscles and Saline Matter in Snow.—M. G. Tissandier.—In the snow which fell between the 16th and 25th of December last, the author distinguished the presence of an abundance of foreign substances, including certain salts. The dry residue from the evaporation of a litre of snow-water was determined. Snow collected in a court yielded 0.212 gm.; from the towers of Notre Dame, 0.118 gm.; and from the country, 0.104 gm. The residue obtained on the evaporation of snow is an impalpable greyish powder, of which the organic matter, rich in carbon, burns brightly. The residual ash amounted to 57 per cent in Paris, and 61 in the country. It consisted of silica, carbonate of lime, alumina, chlorides, sulphates, nitrate of ammonia, and very appreciable amounts of iron. He suggests that a portion of the matter suspended in the air may have a cosmic origin.

Researches on the Gastric Juice.—M. Rabuteau.—The author confirms the results of Braconnot, Prout, Lassaigne, and Schmidt, showing that the acidity of the gastric juice is due, not to the lactic, but the hydrochloric acid.

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Moniteur Scientifique, du Dr. Quesneville,
December, 1874.

Chemical Products at the Vienna Exhibition.—M. E. Kopp.—(Continued.) An account of the pharmaceutical products, essential oils, perfumery, drugs, and raw materials for pharmacy and chemical manufactures.

According to M. Ch. Kopp, of Neufchatel, the specific gravity of different kinds of diamonds is—

- | | |
|--|-------|
| 1. Ordinary crystalline diamond, for ornamental purposes | 3.550 |
| 2. White diamond in natural grains | 2.636 |
| 3. Black diamond in natural grains | 2.653 |
| 4. Grey diamond of commerce in fragments | 3.596 |
| 5. Black artificial diamond | 3.412 |

Certain Properties of Weighted Black Silks.—M. J. Persoz.—The author shows that weighting—which began with the modest aim of making up the loss sustained in ungumming—is now carried to the extent of 100, 200, and 300 per cent. This increase of weight is produced by treatment with salts of iron and astringents, salts of tin and cyanides. The bulk is augmented proportionably to the weight. As a matter of course, the chemical and physical properties of the silk thus treated are materially modified. What is sold as silk is, in fact, a mere agglomeration of heterogeneous matters, devoid of cohesion, held temporarily together by a small portion of silk. The elasticity and tenacity of the fibre are sensibly reduced. From being in its natural state one of the most permanent of organic bodies, and sparingly combustible, burns like tinder if touched with flame. It is, moreover, liable to undergo spontaneous decomposition, and to absorb gases with the evolution of heat, which sometimes leads to actual combustion. The adulterated silk when burning scarcely gives off the characteristic odour of animal matter. It leaves an ash of oxide of iron, exceeding 8 per cent.

Industrial Preparation of Sulpho-Carbonate of Potash.—M. A. Gelis.—Already noticed in the CHEMICAL NEWS.

Applications of Indigo.—M. A. Schultz.—Reserved for insertion in full.

Titration and Assay of Manganese.—M. A. G. Pouchet.—Reserved for insertion in full.

Volumetric Determination of Copper Applicable to the Analysis of Ores, Alloys, Bronzes, and to Toxicological Cases.—M. Prosper Lagrange.—Reserved for insertion in full.

Les Mondes, Revue Hebdomadaire des Sciences.
No. 16, December 17, 1874.

M. F. Guicheteau finds that vines and trees infested by the phylloxera may be cured by driving common iron nails into the trunk.

Chalk as a Source of Heat.—M. Maridort thinks that in a common household fire lumps of chalk mixed with the coal may increase the proportion of heat utilised, though not the amount actually produced. In the furnace of a steam-boiler the addition can be only pernicious.

No. 17, December 24, 1874.

The only chemical paper in this number is an account of the manufacture of chlorine, by Mr. W. Weldon.

Reimann's Farber Zeitung, No. 47, 1874.

The editor announce that one of "our leading practical dyers" has succeeded in constructing a machine which performs all the manipulations of mordanting, dyeing, washing, &c., automatically, in the shortest possible time, and in a more trustworthy manner than the best workman.

Another discovery is a method of fixing all the aniline colours upon wool, much faster, and with increased lustre. The dye-kettles can be exhausted in one operation till clear as water, and heavy shades can be dyed in very dilute solutions. Colour is thus economised, and the inconvenience of smearing in dark shades is avoided. All blue tones can also be produced in full brightness from the redder kinds of methyl-violet.

It is further announced that an eminent chemist is in the very act of discovering the long-sought-for constitution of ultramarine—a matter which will be of the highest importance for a manufacture which has hitherto groped about in the dark.

Then follow receipts for the manufacture of artificial purpurin; for dyeing woollen knitting-yarn; for a black on woollen cloth; for a blue-green on cotton-yarn; a marine blue on silk; a black (printed) on woollen pieces and yarns; and a green and black (printing) on calico.

Liebig's Annalen der Chemie und Pharmacie.
November 9, 1874.

Contributions to the Knowledge of the Ammonia Derivatives of Benzol.—Dr. H. Salkowski.—(Second part; compounds of the benzol series.) In this paper the author treats of the trinitro compounds, including picric ether (trinitro-aniline); picric methylic ether (trinitro-anisol); the reduction of trinitro-aniline, resulting in dioxy-diamido-benzol. Passing to the dinitro compounds, he treats of experiments with the α series, the reduction of α -dinitranilin, the sulphate of tri-amido-benzol, the conversion of α -dinitranilin into dinitro-benzol; experiments in the β series, β -dinitro-anisol, the solubility of α - and β -dinitro-anisol in alcohol; β -dinitro-phenetol; β -dinitro-aniline; solubility of α - and β -dinitro-aniline in alcohol; the transformation of β -dinitro-aniline into dinitro-benzol; the mono-nitro compounds; experiments in the ortho- and para series; and decomposition of para-nitro-anisol by ammonia.

Synthesis of Methyl-Aldehyd.—B. C. Brodie.—After the gas—which the author had obtained by the action of electricity upon about equal volumes of hydrogen and carbonic acid—had been freed from carbonic oxide, carbonic acid, and traces of oxygen, there remained 191.2 volumes, which, on analysis, were found to contain 2.6 volumes of nitrogen. Deducting this, there remained 188.6 volumes, which was found to consist of—

Hydrogen	183.2
Marsh-gas	0.2
Methyl-aldehyd	5.2
	188.6

Its percentage composition is therefore—

Hydrogen	97.14
Marsh-gas	0.10
Methyl-aldehyd	2.76
	100.00

Communications from the Laboratory of Professor Wislicenus, in Würzburg.—These consist of a paper on para-di-pimalic acid, diacrylic acid, and para-di-pinic acid, by J. Wislicenus, in which we have an account of the preparation of para-di-pimalic acid from the decomposition of glycerin-iodo-propionic acid with oxide of silver; the behaviour of the para-di-pimalates at elevated temperatures; and a notice of the salts of diacrylic acid, and the reduction of para-di-pimalic acid by hydriodic acid. Next follows a memoir on the constitution of dinitro-ethylic acid, by Sylvester Zuckschwerdt; a paper on the products of the oxidation of ethyl-sulphinic acid by nitric acid, by the same author; an essay on the constitution of crotonic acid, by W. Hemilian; and a memoir by Dr. Hermann Goldenburg on the action of nascent hydrogen upon benzoin.

Remarks on the Javanese Calisaya, and on Conchinin.—O. Hesse.—The author holds that the species cultivated in Java is not the true calisaya of Weddell, but a distinct, though closely approximating species.

Communications from the Chemical Laboratory at Griefswald.—These include a memoir by Dr. M. Hayduck on ortho-amido-para-sulpho-toluolic acid, giving an account of its behaviour with concentrated sulphuric acid; the behaviour of the diazo compound of the amido acid with acetic acid, hydrated and anhydrous, and phenol, behaviour of ethyl-cresol-sulphuric acid when heated and melted with hydrate of potash; behaviour of the diazo compound with fuming sulphuric acid; nitro-ortho-brom-para-sulpho-toluolic acid; amido-ortho-brom-para-sulpho-toluolic acid; amido-para-sulpho-toluolic acid; the met

morphoses of di-brom-ortho-amido-para-sulpho-toluolic acid; di-brom-ortho-cresol-para-sulphuric acid; the di-brom-ortho-cresol-sulphates of baryta and lime; tri-brom-para-sulpho-toluolic acid, and its baryta and lime salts; the nitro-diazo compound of di-brom-ortho-amido-para-sulpho-toluolic acid; and a paper by M. Schäfer on certain brom-amido-sulpho-toluolic acids.

Fumaric Acid and Optically Inert Malic Acid Prepared from Glyceric Acid.—A. Wesigo and Tanatar.—Fumaric acid and inactive malic acid are formed when the two atoms of chlorine in bichloro-propionic ether are replaced by carboxyl. Not a trace of succinic acid was formed.

Preparation of Chloride of Ethyl and its Homologues.—C. E. Groves.—From the *Journal of the Chemical Society*, July, 1874.

Preparation of Iodised Substitution-Products with Iodine and Oxide of Mercury.—P. Weselsky.—An appendix to the author's memoir, *Annalen*, 174, 99.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

The manufacture of paint from a black powder obtained by the utilisation of a chemical by-product or refuse hitherto considered useless, and for improved apparatus connected therewith. Robert Owen, Bowdon, Chester. April 27, 1874.—No. 1465. This invention consists, first, in the discovery that the by-product refuse or residue arising from the manufacture of prussiate of potash, and commonly called by the manufacturers animal charcoal or carbon, contains fine particles in sufficient quantities to enable a good and durable black or bluish paint to be obtained with great economy; and, secondly, in improved apparatus for effecting the separation of the particles. The residue contains ashes or gritty matters and traces of potash enveloping or mixed among the fine particles of carbon or charcoal; and these coarse and fine matters have to be separated by washing or other means for the purpose of enabling the fine particles to be used as a powder which, when worked up with boiled linseed oil and other matters used by painters, produces a black paint; bluish shades can be obtained by an admixture of any of the drugs used by dyers for the purpose of having blue tints.

Improvements in the preparation of articles to be electro-plated or coated with nickel and other metals by electricity. Henry John Brook, Edward Goodrick Draper, and John Unwin, electro-platers, all of Sheffield, York. April 29, 1874.—No. 1492. Our invention relates to and consists in the use of two certain substances, such as lime and rouge, to be used either separately or combined in preparing articles to be electro-plated or coated with nickel and other metals. We take the ordinary quick-lime and pound it very fine, and then add a certain portion of rouge, making a smooth fine powder: the same is then applied to the articles with a suitable piece of cloth or leather, carefully rubbing every part until all grease or dirt be removed from them. They are then placed in a dry state in the bath or solution to receive the deposit of nickel or other metals.

Improvements in the preparation and the electro-deposition of nickel upon metals. William Baker and John Unwin, both of Sheffield, York. April 29, 1874.—No. 1493. Our invention relates to and consists in the preparation and use of an improved solution of nickel for the purposes of the electro-deposition of that metal upon iron, copper, and other metallic and conducting surfaces. Our improved solution is composed of nickel oxide and an alkali, such as soda, potash, or ammonia, or a mixture of two or all of these alkalies, and the whole dissolved in tartaric acid; and we use the resulting solution as a bath for the electro-deposition of metallic nickel, which will produce a reguline adhesive deposit. The following are the proportions which we find convenient, namely,—100 lbs. sulphate of nickel, 53 lbs. tartaric acid, 14 lbs. caustic soda. Or we take—100 lbs. sulphate of nickel, 67 lbs. cream of tartar.

The preparation of improved materials for disinfecting and deodorising purposes. Francis Thomas Bond, M.D., Gloucester. April 30, 1874.—No. 1510. The object of this invention is to combine certain metallic and other matters, especially the sulphates or chlorides of aluminium, iron, or copper, with sawdust, so that the latter shall be saturated therewith. For certain purposes the oxides of the said metals are precipitated in and upon the sawdust by treating it, when saturated with the said salts, with ammonia; or carbolic acid is combined therewith.

Improvements in purifying the quinoidine of commerce. William Henry Maxwell Blews, manufacturer, Birmingham, Warwick. (A communication from Dr. J. E. de Vrij, Hague, Holland.) May 1, 1874.—No. 1534. This invention consists in treating the dark brown solution of the quinoidine of commerce by means of a solution of hyposulphite of sodium or other salts, whereby the solution is deprived of a dark resinous matter, and the quinoidine thus purified forms with acids very soluble compounds, which do not melt at a temperature of 212° F., and form a powder which is only very slightly coloured.

Improved manufacture of gas for heating purposes. Sir Francis Charles Knowles, Bart., Lovell's Hill, Berks. May 2, 1874.—No. 1550. This consists, first, in obtaining pure carbonic oxide by calcining limestone or chalk, and then converting into carbonic oxide the car-

bonic acid gas evolved; and, secondly, in mixing black oxide of manganese with charcoal of wood, or of peat, coke, or anthracite coal.

An improved method for the recovery of sulphuric acid when combined with certain chemical products. Thomas Jackson, manufacturing chemist, Clayton, near Manchester, Lancaster. May 5, 1874.—No. 1583. My invention consists in recovering sulphuric acid when combined with nitric acid, muriatic acid, benzol, naphtha, or any other coal-tar oils by means of chlorine or any other oxidising agent.

An improved composition for preserving metals from oxidation. Alberto Ara and Mario Del-Bubba, both of Florence, Italy. May 6, 1874.—No. 1595. Equal quantities of quartz and metallic oxide and a suitable solvent are employed, and after being reduced to fine powder, water is added. The mixture thus formed is applied by means of a brush to the articles to be preserved. They are then exposed to the open air to dry, and afterwards placed in muffles and heated to about 800° C.

Improvements in the preparation of caustic alkali packages. Alfred Vincent Newton, mechanical draughtsman, Chancery Lane, Middlesex. (A communication from Benjamin Talbot Babbitt, New York, U.S.A.) May 6, 1874.—No. 1601. The invention consists, first, in a ball, slab, or block of caustic alkali, hermetically sealed and protected from atmospheric influence by means of a coating or envelope of turpentine; secondly, in a process of coating packages of caustic alkali by submerging in the coating substance or composition while it is in a liquid state in a vessel in which a vacuum is produced above the liquid.

A new process of manufacturing alcohols by a methodical and endless manner with wines and fermented juices of any kind by means of new or improved apparatus suitably disposed for the purpose. Alphonse Piver, manufacturer of perfumery, Boulevard de Strasbourg, Paris. May 7, 1874.—No. 1607. In this process the temperature of the wine or fermented juices to be distilled to obtain alcohol is at once raised to a higher degree than usual in a boiler of special construction, forming the basis of a system of eliminating apparatus; the juices, heated by steam at high pressure passing through a worm within the boiler, ascend through a central pipe to the upper part of this boiler, entering a chamber forming rectifying column, from whence they run into a cooling chamber, in which the cooling liquid is wine flowing into it from an upper cistern. The vapours of the essential or empyreumatic oils produced by the heat ascend through a tube to enter a rectifying column, where the less volatile part is liquefied and collected as alcohol of bad flavour, whilst the vapours of essential oil are conveyed into a cooling chamber, where they are condensed. The wine or fermented juices separated from the essential or empyreumatic oils in the first column of elimination, and conveyed into a cooling chamber, are conveyed from thence into a series of special rectifying columns and cooling chambers where the alcoholic vapours are condensed, and finally collected in the purest and highest quality, whilst the exhausted juices, entirely deprived of their volatile parts, are run out. The process is continuous, there being no stoppages of the distillation because of the mixing of a few drops of essential or empyreumatic oils with the alcohol, as is now the case, and the constant watching of the process is no longer necessary.

Improvements in the manufacture of soap. Alfred Vincent Newton, mechanical draughtsman, Chancery Lane, Middlesex. (A communication from Gaetano Tardani, Rome, Italy.) May 7, 1874.—No. 1614. In the manufacture of soap the patentee takes oil, or suet, or other fatty matter, and places it in a flat-bottomed iron boiler constructed in the form of a truncated cone, together with double the quantity of water, and a proportion of oxide of calcium or quicklime, rendered previously slack by means of a quantity of water. The whole must be boiled and mixed by means of a mechanical agitator.

MEETINGS FOR THE WEEK.

MONDAY, Feb. 8th.—Medical, 8.

— Geographical, 8.30.

— London Institution, 5.

— Society of Arts, 8. (Cantor Lectures.) Rev. Arthur Rigg, M.A., "The Material, Construction, Form, and Principles of Tools and Contrivances used in Handicraft."

TUESDAY, 9th.—Civil Engineers, 8.

— Royal Institution, 3. E. Ray Lankester, M.A., "On the Pedigree of the Animal Kingdom."

— Photographic, 8.

— Anthropological, 8.

— Society of Arts, 8. Mr. William Babington, "A General Description of the Trade on the West Coast of Africa."

WEDNESDAY, 10th.—Geological, 8.

— Society of Arts, 8. Mr. W. Newton, "The Sandblast and its Adaptation to Industrial Purposes."

THURSDAY, 11th.—Royal, 8.30.

— Royal Institution, 3. Professor Tyndall, "On Subjects Connected with Electricity."

— Birkbeck Scientific Society. Mr. J. A. Barnard, "Volcanoes, Earthquakes, and other Subterranean Phenomena."

FRIDAY, 12th.—Royal Institution, 8. Weekly Evening Meeting. Mr. W. R. Greg, "Life at High Pressure." 9.

— Royal Astronomical, 8. (Anniversary.)

— Quekett Club, 8.

— Society of Arts, 8. Mr. Frederick Drew, "On the Possibility of Adapting the Roman Alphabet to the Languages of India."

SATURDAY, 13th.—Royal Institution, 3. Mr. J. T. Wood, "On the Discovery of the Temple of Diana, and other results of the Government Excavations at Ephesus."

THE CHEMICAL NEWS.

VOL. XXXI. No. 794.

ON THE USE OF STANNOUS CHLORIDE AS A REDUCING AGENT IN THE

TECHNICAL ASSAY OF IRON ORES, &c.

By W. F. K. STOCK, F.C.S., and W. EDWIN JACK.

In a previous communication (CHEMICAL NEWS, vol. xxx., p. 221), we spoke of the application of stannous chloride as a reducing agent for assay of iron ores, and the observations we then made led to a little adverse criticism by another author, who recommended the use of ammonium sulphide. Partly on this account, but more from the fact that no analytical text-book within our reach gave what we considered reliable information as to the method of working with tin-salt, we have made some careful experiments in this direction, not only in order to establish the accuracy of results yielded by it, but to show that, for rapidity of action and simplicity of detail, it stands first for its purpose in the technical determination of iron.

Referring to published information upon the use of stannous chloride as a reducer for ferric salts, we find the following objections presenting themselves, viz., the fear of adding excess of stannous salt, and the want of suitable means to prevent such excessive addition; but we have proved that, by the method of use given below, these objections no longer hold good.

In this process 1 grm. of ore is dissolved in 30 c.c. of strong HCl, or, if not decomposed by HCl, it is first fused with alkaline carbonate, and brought into HCl solution; in either case, the solution is made up to 500 c.c. with distilled water and caused to boil. The stannous chloride may now be added in small portions at a time, but it *must* be in *dilute clear acid* solution, a convenient strength containing 10 grms. of tin per litre. The colour of the ferric solution is a fair guide to the addition of the tin-salt within certain limits; but when the colour becomes faint some other indicator must be used, and this we find in a dilute, recently-prepared solution of potassium sulphocyanate, which is disposed in drops over the surface of a white tile. Special care must be taken to add the trial drops of iron solution quickly to those on the tile, and to have the beaker containing the solution in pretty close proximity to the tile, so as to guard against oxidation of solution on the glass rod with which the test drops are added. The reduction is carried so far, that only a faint tinge of pink is produced when the last addition of tin-salt has been made and allowed to boil for a few moments. The next step is the titration with potassium bichromate; and, as a vital part of the process, we make the preliminary addition of three drops of bichromate (standard solution 1 c.c. = 0.01 grm. iron), then test with potassium sulphocyanate. A distinct access of colour in this test, as compared with the last test made in reducing, is accepted as proof of the absence of stannous salt, and it only remains to complete the assay in the usual manner.

We have made a large number of assays by this method, and have tested its capabilities, thoroughly comparing it with pure zinc, ammonium sulphide, sulphurous anhydride, and sodium bisulphite, and it has given us every satisfaction. It requires no filtration, no prolonged boiling to eliminate dissolved gases, and there is no fear of loss from effervescence, &c.; and we are sure that when we state that by other processes the time occupied by a reduction alone is not less than from thirty to forty-five minutes, and that by tin-salt ten minutes are sufficient for the purpose, one, and not the least, of its advantages must be evident.

It only remains for us to give some experimental proof of the accuracy of the method, and this we do by reproducing the following from our note-book.

- (1). 0.3120 grm. annealed iron wire, known from analysis to contain a mere trace of foreign matter, was dissolved in HCl, treated with Cl water, boiled to expel free Cl, diluted to 500 c.c., reduced with SnCl₂ solution, and titrated with standard bichromate, of which each c.c. was worth 0.00997 grm. iron. 31.3 c.c. were used = 0.3120 grm. iron in wire.
- (2). 0.3470 grm. wire treated as above gave 0.3369 grm. iron.
- (3). 0.3650 " " " " 0.36589 grm. iron.

From these results, it is evident that the process loses nothing in exactness, from the fact of the whole of the iron existing as ferric salt.

Laboratory and Assay Office, Darlington,
February 1, 1875.

LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE

CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

(Continued from page 26).

LECTURE VI.

In his sixth lecture, Mr. Maskelyne discussed the general subject of geometrical symmetry, first in relation to a plane, and then in relation to a solid figure, and afterwards considered in what way the principles of geometrical symmetry could be applied to the symmetry of the faces, or again of the forms of crystals. A plane figure, for instance, is symmetrical to a point, that is, is centro-symmetrical when straight lines passing through the point meet at equal distances from it corresponding points of the figure. Similarly, in the case of symmetry to a line, perpendiculars on the line meet corresponding points on the figure at equal distances from the line, and the figure may be symmetrical to two or more intersecting lines. The portions of a figure symmetrical to a line will not necessarily be congruent without retroversion over the line. A solid figure, again, may be symmetrical to a centre or to a plane, or to several intersecting planes, or it may be symmetrical to a line or axis of symmetry; and such an axis may be an axis of diametral, trigonal, tetragonal, &c., symmetry. In such cases, a radius vector perpendicular to the axis of symmetry at any point upon it will meet corresponding points of the solid at equal distances from the axis as it moves in a plane perpendicular to that axis—

Through π when it is an axis of diametral symmetry.

" $\frac{\pi}{2}$ " " tetragonal "

" $\frac{\pi}{3}$ and $\frac{\pi}{6}$ in the cases of trigonal or hexagonal symmetry.

It is evident that crystals can only in a conventional sense be said to be symmetrical figures in the meaning here given to the word; but, either by considering a crystal form as an ideal figure constructed in equipoise, that is to say, with its faces parallel to the faces of the form, and with corresponding faces at equal distances from the centre, or, again, by considering the relative positions of the poles of the faces as distributed on the sphere of projection, we are in a position to deal with the symmetrical relations of crystals very much as if those natural bodies were really constructed in true geometrical symmetry.

It will be necessary, with this view, first to consider the kinds of symmetry that the faces or that the poles of a form belonging to one zone may exhibit. If there be a plane of symmetry controlling the zone, and therefore passing through its centre, it is clear that every face-normal belonging to the zone will be one of a pair of normals equally inclined on that plane; and also it will be seen, from what was previously said about the harmonic ratio, that a supplementary plane perpendicular to the first plane of symmetry will be potentially a plane of symmetry. Whether it is an actual plane of symmetry or not will depend on whether the zone is centro-symmetrical, *i.e.*, whether each normal is represented by two parallel faces at its extremities, or by only one. In the general case, however, we assume it to be centro-symmetrical.

A zone symmetrical to one plane only will be said to be euthy-symmetrically divided by that plane; where the supplementary plane is also symmetrical, the zone is said to be ortho-symmetrically divided by the two planes. It is clear that, if there be more than one plane of symmetry to a zone, since each of these planes will be symmetrically repeated in respect to each other, we should have a series of consecutive planes of symmetry inclined to one another at the same angle; and, since this angle will be commensurate with π , while the planes form a group in anharmonic ratio, this angle can only be one of the four crystallometric angles, 90° , 45° , 60° , and 30° .

If now, for example, we have three planes of symmetry. a pole on the zone circle will be repeated in six poles lying

FIG. 7.



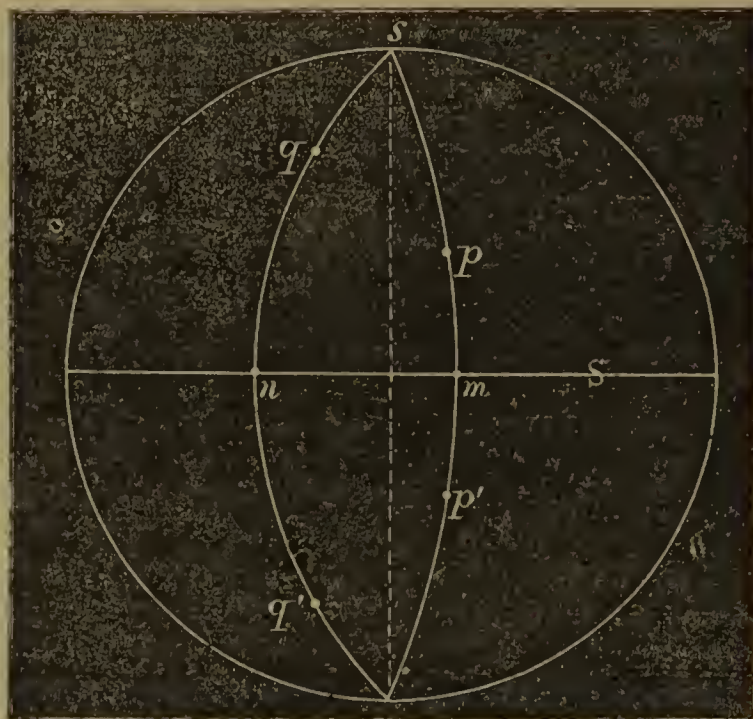
in pairs symmetrically to each plane of symmetry, as in the figure, and the zone axis will be an axis of trigonal, or rather, in this case, what will be termed di-trigonal, symmetry. If the zone be centro-symmetrical, the poles are twelve in number, and the axis has a di-hexagonal character.

LECTURE VII.

WE next pass on to consider the conditions involved in a plane becoming a plane of symmetry to a crystal. Here, evidently for each plane of the crystal, or, what is the same thing, for each pole of the crystal, there must exist a corresponding pole tautozonal with it and with the plane of symmetry, and equidistant with it from the circle in which the latter plane meets the sphere. Every plane of the crystal therefore lies in a zone perpendicular to the plane of symmetry, euthy-symmetrically divided by that plane; and this zone will also be potentially symmetrical to a plane perpendicular to the plane of symmetry, the pole of which will lie on the great circle of symmetry. That great circle of symmetry will then be itself a zone circle, and its pole, in which all the zone circles of the kind just considered

will intersect, is also a possible pole of the crystal. Hence, for a plane to be a plane of symmetry, the necessary conditions are, that it shall be a zone plane, and also parallel to possible faces of the crystal; conditions, however, which are by no means sufficient for determining its symmetrical character.

FIG. 8.



In Fig. 8, if S is a plane of symmetry, and $p p'$ two poles symmetrical to it, the zone circle $[p p']$, and, similarly, a second zone circle $[q q']$, will be actually symmetrical to the plane S , and potentially also to the plane of which m is the pole; and the zone $[q q']$ will also be symmetrical to S and n . So m and n are possible planes, a plane of which n is the pole, and, on the assumption of centro-symmetry are actual planes, in a zone $[m n]$, *i.e.*, $[S]$; and, further, s , the pole of S , is a possible pole, since $[p p']$ and $[q q']$ are tautohedral in S .

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 4th, 1875.

Professor ODLING, F.R.S., President, in the Chair.

THE names of the visitors having been announced and the minutes of previous meeting read and confirmed, Mr. John Mc'Dougall was formally admitted a Fellow of the Society. The names read for the first time were those of Messrs. C. T. Whitmell, B.A., T. Howard, J. W. Biggart, E. L. Fleming, J. J. Ackworth, A. Senier, M.D., F. MacKinnon, J. G. Gordon, J. W. Bell, and Captain Douglas Galton, F.R.S. For the third time—Messrs. George Turner, Robert G. H. Goffin, William Armstead, M.B., William Mc'Cowan, and David Johnson, who were then ballotted for and duly elected.

The first paper, by Mr. G. WHEWELL, was entitled "*Test for Carbohc Acid.*" The author states that when carbohc acid is added to concentrated sulphuric acid a bluish green ring is produced at the point of contact. A "ring" is also produced with various other acids and salts a list of which is given, whilst certain salts and acids "prevent the formation of the ring."

The PRESIDENT said he was sorry Mr. Whewell was not present to give further particulars as to the visible effect produced in these reactions, as it did not clearly appear what the nature of the "ring" was, which was said to be formed by the presence of certain salts and prevented by certain other salts.

Mr. J. WILLIAMS exhibited a specimen of methyl salicy,

late or artificial oil of Gaultheria. The salicylic acid used in its preparation had been made by Kolbe's process of passing carbonic anhydride over sodium phenate heated to 230° C. In answer to a question of the President, he said that the process answered admirably when only a few ounces of the phenate were operated on, one half of the phenol distilling over, and the other half remaining in combination with the sodium as sodium salicylate; on a large scale, however, when several pounds were employed, there were difficulties arising apparently from the impossibility of maintaining the temperature constant throughout the mass. The antiseptic properties of the acid were very great; it entirely prevented fermentation in an infusion of malt, or any change taking place in milk for a considerable time.

Dr. THUDICUM said there was no evidence whatever of the disinfecting power of salicylic acid. It seems to prevent the germination of fungoid growths, but it must not, therefore, be concluded that it was antiseptic or disinfectant.

Dr. FRANKLAND observed that as it prevents the development of these lower organisms it would seem to be a disinfectant, yet its action in preventing the conversion of amygdalin into oil of bitter almonds by synaptase, would, on the other hand, seem to be a chemical one.

In reference to a remark of Dr. STEVENSON on the reputed antiseptic power of boracic acid,

Mr. DAVID HOWARD said he did not know what its antiseptic power might be, but boracic acid certainly destroyed vegetable growth—grass, for instance—with a vigour and permanence, which, if it were a fertiliser, would render it invaluable; he could not say what its effects were on the lower organisms.

Mr. A. SMEE, Jun., had found that if 1 part of a 10 per cent solution of boracic acid were added to 8 of milk it would keep it sweet for a week.

Dr. J. EDMUNDS, in a complicated case of amputation of the thigh, had employed dressings of lint, steeped in a hot saturated solution of boracic acid, with most satisfactory results in preventing putrefactive discharge. The bandage could remain for 36 to 48 hours without the slightest putrefactive odour.

A note "On the Action of Anhydrous Ether on Titanium Tetra-chloride," by P. PHILLIPS BENSON, B.Sc., was then read. If a molecule of each of these bodies be mixed, a violent action takes place, and the liquid becomes dark brown and syrupy. On submitting it to fractional distillation a yellowish oily liquid first passes over between 105° and 120° C. This solidifies on cooling to an amber coloured crystalline mass easily decomposable by moisture. It melts between 42° and 45° C. The mean of several analyses show it to have the formula $\text{TiCl}_4(\text{C}_4\text{H}_{10})\text{O}$.

	Analyses.	Calculated.
Ti	18.54	18.79
Cl	53.17	53.39
C	17.86	18.04
H	4.03	3.75
O		6.03
		100.00

At 135°—145° unaltered titanium chloride distils over, and at 160°—172° C. a pale yellow mobile liquid, which on cooling deposits crystalline nodules, consisting of well formed opaque crystals which melt at 76°—78° C., and boil between 186° and 188° C. (corrected). The analyses show it to be titanium-ethyl-trichlorhydrin, $\text{TiCl}_3(\text{C}_2\text{H}_5\text{O})$.

	Analyses.	Calculated.
Ti	25.16	24.88
Cl	53.44	52.85
C	11.86	11.91
H	2.75	2.48
O		7.95
		100.00

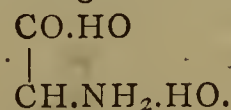
The PRESIDENT, in thanking the author, remarked that there were many chemists present to whom the formation

of these organic bodies would be very interesting. The one might be viewed as titanium chloride, in which one of the chlorine was replaced by oxethyl; in the other the molecule was far more complex.

The last paper, "On Dibrom-Acetic and Glyoxylic Acids," by W. H. PERKIN, F.R.S., was read by the author. After adverting to his former researches on dibromacetic acid, made in conjunction with the late Mr. Duppa, the author stated that the dibromacetic acid used in the present experiments was prepared by the action of bromine on acetic anhydride, thus avoiding the use of sealed tubes. When the silver salt of this acid is boiled with water until silver bromide ceases to be deposited, dibrom-acetic and glyoxylic acids are found in the solution in the proportions represented by the equation—



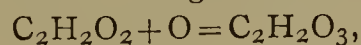
Silver dibrom-acetate, when heated with absolute alcohol, gave no definite results; but with dry ether a compound, $\text{C}_4\text{H}_2\text{Br}_2\text{O}_4$, seems to be formed, which may be regarded as *dibrom-aceto-glyoxylid*, since by the action of water it is resolved into dibrom-acetic and glyoxylic acids. To prepare glyoxylic acid, the author boils silver dibrom-acetate with water, separates the silver bromide formed, neutralises with argentic carbonate, and again boils. The concentrated solution, when exposed for a week or so over sulphuric acid, yields glyoxylic acid in the crystalline state as oblique rhombic prisms having the formula $\text{C}_2\text{H}_4\text{O}_4$. When heated with absolute alcohol to 120° C., it yields the compound $\text{C}_2\text{H}(\text{C}_2\text{H}_5)_3\text{O}_4$, *diethyl-glyoxalate of ethyl*. The author has also prepared the potassium, sodium, silver, and calcium salts. When calcic glyoxalate is decomposed by ammoniac oxalate, or glyoxylic acid is neutralised with ammonia, a neutral solution is obtained which, when evaporated *in vacuo*, becomes acid, and ultimately yields a crystalline product having the formula $\text{C}_2\text{H}_5\text{NO}_3$ or—



When calcic glyoxalate is decomposed by aniline oxalate, a clear solution is obtained, but this also quickly decomposes, becoming turbid and depositing a yellow uncrystallisable powder.

The PRESIDENT said that all there present interested in organic chemistry knew that the formula of glyoxylic acid was a sort of test question of great theoretical importance; but, whether we adopted the conclusions of Mr. Perkin or those of Dr. Debus, there could be no doubt of the great value of the contribution to the history of glyoxylic acid which had just been brought before them.

Dr. DEBUS quite agreed with the President in his remarks that Mr. Perkin has added a most valuable contribution to the history of the acid; but the question was, as to whether the formula for glyoxylic acid was $\text{C}_2\text{H}_2\text{O}_3$ or $\text{C}_2\text{H}_4\text{O}_4$. He was originally inclined to believe it to be the latter, but was ultimately led to adopt the formula $\text{C}_2\text{H}_2\text{O}_3$, for the following reasons. When alcohol is oxidised it is successively converted into aldehyde, $\text{C}_2\text{H}_4\text{O}$, acetic acid, $\text{C}_2\text{H}_4\text{O}_2$, and glycollic acid, $\text{C}_2\text{H}_4\text{O}_3$. The latter partook both of the alcoholic and of the acid nature, and when it lost H_2 it became glyoxylic acid, $\text{C}_2\text{H}_2\text{O}_3$, which was both aldehyde and acid. Again, in the oxidation of glycol, $\text{C}_2\text{H}_6\text{O}_2$, a body, glyoxal, $\text{C}_2\text{H}_2\text{O}_2$, was produced aldehydic in its nature, and about whose formula there was no manner of doubt. This, by oxidation, became glyoxylic acid in the following manner:—



being strictly in accordance with the fact that all acids formed from aldehydes by oxidation contain the same number of hydrogen atoms as the aldehyde from which they are derived. This was the general evidence. The direct evidence was in the ammonium salt, a definite crystalline body having the formula $\text{C}_2\text{H}(\text{NH}_4)\text{O}_3$. This compound was exceedingly decomposable, and could only be obtained by the evaporation of concentrated solutions

vacuo at a low temperature. Its aqueous solution was nearly neutral, and gave all the reactions of an ammonium salt with platinic chloride, tartaric acid, and caustic soda, similarly for glyoxylic acid. He considered that glyoxylic acid was both acid and aldehyde, and its nature might be expressed thus: $C_2H_2O_3 = COH.CO(HO)$. Thus all he knew led to but one conclusion, that the formula of the acid was $C_2H_2O_3$, and not $C_2H_4O_4$.

Mr. PERKIN replied that, in adhering to the formula $C_2H_4O_4$, he was more inclined to regard the facts established by the analytical results, than purely theoretical considerations. The oxidation of glyoxal into glyoxylic acid, which was instanced, took place in aqueous solution, and there was no evidence to prove that the former did not take up water when dissolved, as chloral was known to do. He had prepared the ammonium compound by neutralising the pure acid with ammonia, and evaporating *in vacuo*; but the solution, although neutral at first, always became acid, and that without any loss of ammonia, as was proved by the proportion of the nitrogen to the carbon remaining the same; a change, therefore, must take place during evaporation, which was corroborated by the behaviour of the aniline compound. If the facts be regarded, there was a long list of definite stable compounds in favour of the formula $C_2H_4O_4$, and not one in favour of the formula $C_2H_2O_3$, since the ammonium compound was so very unstable, and from its properties he could not regard it as a true salt. The aniline salt, also, as soon as it is formed, begins to decompose.

Dr. ODLING said, if he might venture to express an opinion, his own views were more in harmony with those of Dr. Debus than with those of Mr. Perkin.

After thanking the author for his valuable paper, the PRESIDENT then adjourned the meeting until February 18th, when there will be a lecture by Professor Clerk Maxwell, "On the Dynamical Evidence of the Molecular Constitution of Bodies."

The Faraday lecture will be delivered by Dr. A. W. Hofmann, on Thursday, March 18th.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

Ordinary Meeting, February 5th, 1875.

Dr. REDWOOD in the Chair.

THE CHAIRMAN, in opening the proceedings, said: Gentlemen,—You are aware that this is a general meeting of our Society, and that, in fact, it is the first of our meetings at which one of the most important objects of the Society will be introduced, viz., that of receiving communications from members relating to the subject of our respective duties as Public Analysts. I will first call upon the Secretary to read the Report of the Council.

The Report was as follows:—

"The circulars which we have addressed to you since the last meeting render it unnecessary for us to give a long report.

"In accordance with the resolution passed on December 1st, we met on December 18th, and again on the 7th January, and, after very full and exhaustive discussion of every proposal which had been made in reference to the definition, each proposition being considered separately and voted on, the definition which has been circulated was unanimously accepted as the Society's definition of an adulterated article. A considerable number of copies have been printed and circulated, and as yet the criticism which has come to our knowledge has been almost unanimous in its favour.

"We have also effected a satisfactory arrangement with Mr. Crookes for the reservation of a

certain space week, in the CHEMICAL NEWS, and our opening address is in type for this week's issue.

"It gives us great pleasure to find that our ranks are increasing, as you will see by the ballot-papers received to-day.

"The Council are paying proper care to the proceedings necessary in connection with the probable new Act, but it is unnecessary to further enlarge on this point, all necessary information on which will be given from week to week in the CHEMICAL NEWS.

"We shall be happy to receive promises of papers to be read at the next meeting."

The following gentlemen were then balloted for and elected as Members and Associates of the Society:—

Members.—John Attfield, Ph.D., F.C.S.; William Crookes, F.R.S., F.C.S.; C. W. Heaton, F.C.S.; W. C. Young, F.C.S.

Associates.—Bernard Dyer; R. H. Harland; A. A. Nesbit; Charles G. Stewart; J. H. Scott.

The SECRETARY (Mr. G. W. Wigner) read the regulations adopted by the Council as to the admission of visitors and the conduct of debates.

The following paper was read by J. ALFRED WANKLYN, M.R.C.S., Vice-President of the Society:—

ON THE DETECTION OF ALUM IN BREAD.

The detection of alum in alumed bread is difficult, owing to a variety of causes. The characters of alumina are not striking, and the phosphates naturally present in bread-ash, and the minuteness of the proportion of alumina in alumed bread, tend to complicate the analysis. The quantity of alum employed in aluming bread is 20 to 30 grains to the 4-lb. loaf, and, although this proportion is occasionally exceeded, a satisfactory method for the detection of alum in bread must be able to cope with such proportions. Now, bread containing 28 grains of alum in the 4-lb. loaf contains 0.1 per cent of alum, or only 0.011 per cent of alumina. If we suppose 100 grms. of such bread to be incinerated, the ash will weigh about 1.400 grms., consisting of common salt, which forms the major portion of it, together with soluble phosphate of potash, and about 0.250 gm. of residue insoluble in water. The 0.250 gm., in this case, will be found to contain the 0.011 gm. of alumina, and the problem to be solved is, how to separate it, or its equivalent of phosphate of alumina, from the remainder of the 0.250 gm., which consists of phosphates of lime and magnesia, a little silica, and a trace of phosphate of iron. For the accomplishment of this task, a method, which is generally ascribed to Kuhlmann, is given in Watts's "Dictionary" (*vide* article, Bread). The method is as follows:—The silica having been removed by a preliminary treatment with hydrochloric acid and evaporation to dryness (by which means the silica becomes insoluble, and may be separated from the rest by filtration), the phosphates are boiled with some solution of pure caustic potash or soda, which dissolves out the phosphate of alumina, leaving the other phosphates insoluble. On filtration, there will then remain the phosphates of lime and magnesia and the trace of phosphate of iron on the filter, whilst the filtrate will contain the phosphate of alumina held in solution by the alkali. The separation of the phosphate of alumina from the alkali presents no difficulties. In carrying out this process, there is a great practical difficulty, as has, doubtless, been frequently observed by those chemists who have had occasion to employ it. The phosphate of lime forms a kind of jelly, which retains phosphate of alumina with such a degree of obstinacy that even boiling potash or soda does not avail to dissolve out a considerable proportion of the phosphate of alumina. In the case we are supposing, where the 0.250 gm. of residue insoluble in water contains 0.011 gm. of alumina (or 0.027 gm. of phosphate of alumina), there is about 0.200 gm. of phosphates of lime, magnesia, and iron, from which the alkali has to dissolve out the 0.027 gm. of phosphate of alumina. On actual

trial in the laboratory, it is found that, though the alkali is capable of removing some of the phosphate of alumina, so as to give a qualitative result, yet that a quantitative result is quite out of the question. A much more promising method of separation has been proposed by Dr. Dupré and described in the CHEMICAL NEWS (xxix., 233). Instead of dissolving out the 0.027 grm. of phosphate of alumina, he dissolves out the 0.200 grm. of phosphates of lime and magnesia, and leaves the phosphate of alumina and trace of phosphate of iron insoluble. The solvent employed is acetic acid, in which the phosphates of lime and magnesia are easily soluble, whilst phosphates of alumina and iron are exceedingly insoluble. In this manner, as will be understood, the mechanical difficulty is got over. This method has been submitted to a prolonged investigation in my laboratory, and the following are the particulars and results.—The quantity of bread which I operate upon is 100 grms., which, having been weighed out, is incinerated in a large platinum dish capable of holding the whole quantity at once. The incineration is managed at a comparatively low temperature, and takes some four or five hours, the platinum dish being heated by means of a large Bunsen burner, abundantly supplied with air. It is well to continue the ignition until the bread-ash is nearly completely burnt, and it is advisable to weigh the dish containing the ash. The weight of the ash should not sensibly exceed 2 grms. The ash having been obtained, is then moistened with 3 c.c. of pure strong hydrochloric acid, and then some 20 or 30 c.c. of distilled water is added, and the whole is boiled, filtered, and the precipitate washed several times with boiling water. In this manner a precipitate consisting of silica together with some unburnt carbon is left on the filter, whilst the filtrate contains the phosphates. The precipitate, which, after being burnt consists of silica, is weighed. The filtrate is mixed with 5 c.c. of liq. ammoniæ (sp. gr. 0.880) whereby it is rendered powerfully alkaline and opaque owing to the precipitation of the phosphates. It is finally mixed gradually with some 20 c.c. of strong acetic acid, and as the acid is being poured in the observation may be made that the liquid is alkaline and opaque until some 5 c.c. of acid has been added, that when about 10 c.c. has been added the liquid is acid and much clearer, and that at least 10 c.c. of strong acetic acid is added after the establishment of a distinctly acid reaction. The liquid is then boiled and filtered, and the precipitate, consisting of phosphates of alumina and iron, well washed with boiling water, ignited, and weighed. The last step is the determination of the iron in the weighed precipitate, and this is accomplished either by reduction and titration with standard solution of permanganate in the well known manner, or else by a colour-process, viz., by titration with ferrocyanide of potassium. In cases where the quantity of iron to be measured is minute, I prefer the colour-process, which will be very simple and easy of execution to all persons who are familiar with the ammonia-process of water-analysis. A few words may be devoted to the description of the process. The colour-titration of iron resembles Nesslerising, a weak standard solution of iron being substituted for the standard ammonia, and a solution of ferrocyanide of potassium for the Nessler reagent. The iron solution may be conveniently made by dissolving a gramme of fine iron wire in nitro-hydrochloric acid, precipitating with ammonia, washing the peroxide of iron and dissolving it in a little hydrochloric acid, and diluting accurately to one litre. This gives a standard solution whereof one cubic centimetre contains one milligramme of metallic iron in the condition of perchloride of iron. This standard (just as in the case of ammonia) may be diluted a hundred times to give the dilute iron solution containing $\frac{1}{100}$ milligramme of iron per cubic centimetre. The remainder of the operation closely resembles Nesslerising. The solution to be tested is put into a cylinder of clear colourless glass, and marked at 50 c.c. capacity, 1 or 2 c.c. of solution of ferrocyanide of potassium is added, and after shaking up and

standing the depth of colour is observed. That being accomplished an imitation of the colour is made with standard iron, and ferrocyanide in another cylinder, and the quantity of iron required for the imitation is the quantity present in the solution under examination. The point of dissimilarity between Nesslerising and this colour-titration is, that whereas Nesslerising takes place in alkaline liquids, this titration requires that the liquid should be considerably acid, and to ensure this, every cylinder containing iron-liquids is first made to receive one cubic centimetre of either concentrated hydrochloric acid, or nitric acid before the addition of the ferrocyanide of potassium. I observe in a recent number of the CHEMICAL NEWS (vol. xxx., p. 257, December 4, 1874), a description of the testing for iron by this colour-process by T. Carnelley, B.Sc., whose observations on the subject I am able to confirm. In order to apply the titration to the mixed phosphates, it is necessary to dissolve them in acid, and it will be found convenient to dilute the solution accurately to 100 c.c., and to take $\frac{1}{10}$ for the colour titration. Having ascertained the amount of iron in the precipitate of mixed phosphates, it is only necessary to calculate it into phosphate of iron, and to subtract the weight of the phosphate of iron from the total weight of the mixed phosphates, and the difference is the phosphate of alumina yielded by 100 grms. of the bread. The following results have been obtained by applying the above-described process to samples of bread presumed to be free from alum:—

From 100 Grammes of Bread.

	Bread-Ash. Grms.	Silica. Grms.	Precipitate Insoluble in Acetic Acid. Grm.
A. ..	1.408	—	0.010
B. ..	1.378	—	0.006
C. ..	1.730	0.018	0.010
D. ..	1.620	0.032	0.014
E. ..	—	—	0.012*
(I.) F. ..	1.383	0.030	0.012
(II.) F. ..	1.324	0.025†	0.014

* This determination was made on 50 grms. of bread.

In the last instance the hydrochloric acid solution of the bread-ash was evaporated to dryness, and re-dissolved in order to render the silica perfectly insoluble; and, as will be seen, there was no increase in the silica, showing that, in the instance of bread-ashes, the evaporation to dryness is superfluous. Samples of A, B, C, and D were bought in the country; sample E is the bread from a West-end club; and F from a shop in Seven Dials, London. The precipitate insoluble in acetic acid contained, in every instance, a large proportion of iron, but, in some cases at least, did not consist wholly of phosphate of iron. On deducting the quantity of phosphate of iron from the total phosphates insoluble in acetic acid, there remains a residue of some 5 or 6 milligrms. It would therefore appear that unalumed bread is liable to contain a minute trace of alumina, which expressed as phosphate of alumina ($\text{Al}_2\text{O}_3\text{PO}_5$), equals 5 or 6 milligrms. per 100 grms. of bread, or 0.005 per cent. If the alum corresponding to this phosphate be calculated, it will be seen that 100 grms. of unalumed bread may appear to contain 0.022 grm. of alum; or, expressed on the 4lb. loaf, there may appear to be 6 grains of alum in it. This agrees very fairly with Dr. Dupré's observation recorded in the CHEMICAL NEWS. I have likewise made some experiments on bread artificially alumed in the laboratory. The sample, F, was taken, and dosed with a solution of ammonia-alum of known strength, and the following results were obtained:—As in the former experiments, 100 grms. of bread was burnt up.

	Bread Ash. Grm.	SiO_2 . Grm.	Precipitate Insoluble in Acetic Acid. Grm.	Alumina added. Grm.	Or Phosphate of Alumina Grm.
I.	1.481	0.034	0.026	0.010	0.024
II.	1.538	0.029	0.041	0.020	0.048
III.	1.496	0.030	0.110	0.040	0.095

The quantity of phosphate of iron yielded by 100 grms. of F before aluming was about 8 milligrms. After aluming and igniting there appeared to be a diminution of phosphate of iron. Possibly this diminution was owing to the chloride of ammonium derived from the alum and common salt in the bread acting on the phosphate of iron at a red-heat, and forming perchloride of iron which would volatilise. From the above it is manifest that—although there is a little irregularity in the quantities of phosphate of alumina obtained from alumed bread—still the difference between alumed and non-alumed bread is quite distinct. In investigating some samples of bread suspected of being alumed, I have found 0.039 gm. of insoluble phosphate in one case, and 0.049 gm. and 0.059 gm. in other cases. The iron present in every instance was ascertained to be very small in quantity. Besides containing alumina, alum contains sulphuric acid; and accordingly it might seem possible to follow the alum through the sulphuric acid. Unfortunately, bread-ash is naturally so highly charged with sulphates that the sulphuric acid in the alum is completely overshadowed by them, as the following experiment shows:—50 grms. of unalumed bread was mixed with 0.5 gm. of pure bicarbonate of soda, moistened with pure water, and ignited. From the ash which resulted 0.142 gm. of sulphate of baryta was obtained. 100 grms. of this bread yielded, therefore, 0.284 gm. of sulphate of baryta. This, if arising from alum, would indicate about 80 grains of alum in the 4-lb.-loaf, from which the inutility of the determination of sulphuric acid in the testing of bread for alum may be appreciated. Connected with this part of the subject a point of great interest may be indicated. If no carbonate of soda be employed, and if unalumed bread be ignited, the yield of sulphate of baryta on treating the bread-ash is very much smaller, viz., about 0.150 gm. of sulphate of baryta per 100 grms. of bread, or about half as much as when carbonate of soda is taken. The explanation of this is, that a large part of the sulphuric acid found in bread-ash does not exist in the bread, but is generated during the incineration, and derives its sulphur from the gluten. In conclusion, I have furthermore to express my thanks to Mr. Nesbit, my assistant, for his careful work, which has aided me greatly in the preparation of this paper.

The CHAIRMAN—The detection of alum in bread is a subject to which Mr. Wanklyn has devoted a good deal of attention. Probably there are few better able to cope with the difficulty attending such an investigation. I shall be very happy to hear any observations from any of the members present. I am very happy to observe that Dr. Dupré, whose process Mr. Wanklyn has so prominently alluded to and so favourably spoken of, is present to-day.

Dr. DUPRÉ—I have heard the paper with considerable interest, and I am glad to see that Mr. Wanklyn has, to some extent, simplified my process, and has, perhaps, therefore, made it more generally applicable; and I hope that after this we shall hear nothing more of the difficulty that analysts have been said to find in detecting alum, or at least alumina, in bread. However, there are a few points to which I should like to refer. The amount of alumina I found in my samples of pure bread and flour would amount to about 9 grains of alum in the 4-lb. loaf. The difference between this amount and that found by Mr. Wanklyn might be due to the difference of our manipulation. I was introducing at the time a new process, and I thought I could not take too many precautions to avoid any possibility of leaving alumina insoluble, therefore I always used the ash with alkaline carbonate, and it is not impossible that some alumina, naturally present in the bread, might have escaped without this process. We all know that clay, for example, and alumina, when strongly ignited, are not readily soluble in hydrochloric acid, and they, without fusion with alkaline carbonates, may be missed and remain with the silica. This may account for the difference between us. Well, now, as to the second point. I have dissolved the phosphate of lime; but I have never precipitated it. I have dissolved the

mixed phosphates in hydrochloric acid, and have precipitated them by the addition of acetate of soda. I found that, under these conditions, boiling always threw down phosphate of lime. I always had in my phosphate of alumina some phosphate of lime. Mr. Wanklyn does not allude to this difficulty. That may be because he employs so large a quantity of acetic acid, and the strong acid causes the phosphate of lime to dissolve; but it is an important point to remember,—that, if the acid is not very greatly in excess, boiling will invariably throw down the phosphate of lime. This difficulty is entirely got over by precipitating in the cold. Even the enormous excess of phosphate of lime is got from the phosphate of alumina if the precipitation is allowed to take place in the cold. Boiling always precipitated some phosphate of lime. The experiments I made came out very accurately. I went down to 5 grains of alum in the 2-lb. loaf. I think the smallest is 10 grains in the 4-lb. loaf; and the error made does not amount to 4 grains of alum in the 4-lb. loaf. It is less than 2 grains of alum in the ordinary loaf. But I think the process, as simplified, is sufficiently accurate, and that we shall hear no more of this difficulty.

Mr. ALLEN—Mr. President, it is with the greatest pleasure that I have listened to Mr. Wanklyn's paper, and Dr. Dupré's very admirable remarks upon it, especially as I have been myself working a good deal recently on this subject of alum in bread, and have instituted a great many experiments, to ascertain which of the published processes was most accurate. I have prepared sets of loaves of bread, with definite amounts of alum; and I have not been content merely with calculating what the bread would weigh, but I have taken a certain definite amount of flour, and water, and salt, so as to work exactly under the same conditions, using brewers' yeast for a ferment. These loaves have been weighed, and the alum always calculated on the weight of the loaf. I have examined several processes in that way—Dr. Muter's, as published in the *Food Journal* some years ago; Dr. Dupré's, as recently published in the *CHEMICAL NEWS*; Mr. Wanklyn's, which was published in Hart's "Manual for Medical Officers of Health"; and Mr. Cleaver's, as published in the *Pharmaceutical Journal*. I may say that for some years I have been using what I may call a modification of Dr. Dupré's method, and, after considerable trouble, I have come to the conclusion that Dr. Dupré's is decidedly the best method we have at the present time; and I have obtained exceedingly satisfactory results in working it out. I have modified it slightly. I have not taken the precaution that Mr. Wanklyn has, of charring at a very low temperature. In fact, I have used a large platinum tray, and burnt it in a muffle at a very high red heat. The ash then has lost a good deal of the salt it would otherwise have contained, and, instead of getting so much as 1 per cent. I very often got less. First, the ash has been boiled with water, and the salt has been estimated in the aqueous solution. Secondly, we got an amount of insoluble ash left. The insoluble ash rises very regularly with the alum when the same sample of flour is used. I do not know how it might be with a different sample of flour. This insoluble ash, after weighing, has been fused with an alkaline carbonate. I have always added a little nitre also, dissolved the fused mass in acid, and then I have evaporated to dryness. I think Mr. Wanklyn did not evaporate to dryness. It has been then re-dissolved, and I have found it very desirable to add sulphuric acid after the evaporation. My notion was that, where there were these phosphates, there was a tendency to form volatile chloride of aluminium; and I preferred to dissolve in hydrochloric acid, and then dissolve the dried residue by means of sulphuric acid, so as to leave the bases partly phosphates and partly sulphates. This has left the silica behind, and I have tested for silica after re-fusing, and found none; but there has always been a residue. Frequently, three-quarters of the total alumina has been left in the insoluble ash when it has been dissolved in sulphuric acid in Mr. Wanklyn's and Mr. Cleaver's systems. Hydrochloric acid answers better, but cannot be trusted. I have followed Dr. Dupré, in precipitating with

acid, and using it cold or very slightly warm. I have not attempted to make any allowance for the phosphate of iron which would be precipitated; but I have always separated the iron by using pure soda prepared from sodium, and have then re-precipitated the phosphate of aluminum from the alkaline solution. In that way I have got good results. I have noticed, also, a peculiarity which is, perhaps, worth mentioning, and that is, that if you use 100 grms. of bread, the number of m.grms. of phosphate of alumina you get is almost exactly the number of grains of alum in the 4-lb. loaf—somewhere about as 39 is to 40; so that you know at once what your precipitate is. I was surprised to see London chemists making so great an allowance for the phosphate of aluminum in the bread, for I have been able only to get 2 m.grms.; and in my experience an allowance of 3 m.grms., per 100 grms. of bread, for phosphate of aluminium naturally present is amply sufficient. I would ask them, with all due deference, whether it is not possible that their flour was adulterated, because millers are in the habit of putting the alum into the flour. Unless you watch the flour in course of preparation, you do not know that the alum is not put into it, and thus added before the bread is made. I would suggest that they should analyse the grain. In the analyses of grain given by Gilbert, Lawes, and other agricultural chemists, we find no notice of alumina, and in pure flour I have not been able to find it. Mr. Horsley's method, with the logwood test, is admirable for ordinary use; I say advisedly "Mr. Horsley's method," because, although it was first proposed by Mr. Hadow, still it is, nevertheless, essentially Mr. Horsley's, in the sense that he made it systematic and really valuable. He used the alcoholic solution of logwood, into which he put an excess of carbonate of ammonia. He soaks the bread in this solution, and then, after six or seven minutes, the bread is taken out and squeezed; and bread containing even 7 grains of alum in the 4-lb. loaf distinctly shows a blue colouration. I could have brought you to-day a set of tests, with continually graduated quantities of alum added, and you could tell almost by the colour how much alum was present until you got to somewhere about 30 grains, and then the colour is so dark a blue that you cannot distinguish any further; that is the higher limit of the test, if I may so call it. I have the greatest confidence in it as a means of detecting alum; only you must not suppose, if you get the blue colouration, that there is alum necessarily present. The colouration simply means that there is something wrong. It may be carbonate of magnesia, or something else, which causes that blue colour; but still, as a means of showing that there is something wrong, the test is valuable. In those samples where there was no alum I got no blue colour. When 7 grains of alum are present in the 4-lb. loaf, this test distinctly gives a blue colour; and the colour was most distinct when the quantity was doubled. So there is no doubt about the test being exceedingly valuable, and any chemist using it will be very pleased with the result. Mr. Wanklyn has examined this question of detecting alum by means of sulphates, and, of course, has come to the conclusion that it is impossible. It has occurred to me to make use of a third constituent of alum, and see whether we could not test it by means of ammonia, for I suppose that all alum that we get commercially now is ammonia alum. I have tried this method myself, but practical difficulties have rendered it impossible. I have endeavoured to use the process of distillation and the estimation of the alum in the distillate. It is a failure in the sense that it boils over, and perhaps in pure flour you might get some ammonia developed also. Mr. Wanklyn says that from 20 to 30 grains of alum is the usual quantity used to adulterate a 4-lb. loaf. That quite agrees with my experience in another part of the kingdom; that is the usual amount which bakers use.

Dr. MUTER—I think that we must all be very much obliged to Mr. Wanklyn for his very valuable paper. I think that his manner of analysis has this difficulty—That it may do comparatively well in the hands of a careful analyst; but I agree that it is, perhaps, better to evaporate to dryness in order to be sure of the insolubility

of the silica, because I am afraid he would be between two fires. In the one case an analyst might ignite at too high a temperature, and then he would have to use a strong acid to separate the silica; and on the other hand, he might not dissolve all the alumina out of the ash if the ash had been burnt at a very high temperature. As far as regards the quantity of alum usually found in loaves, I must confess as another London chemist, that I agree with Mr. Wanklyn and Dr. Dupré, especially with Dr. Dupré. I have found nearly 10 grains of alum in a 4-lb. loaf of bread that was perfectly free from adulteration, and I have also examined the flour from which that bread was made. I had a curious case in reference to that. A man who was perfectly innocent of adding alum was proved to have it in his bread, and it caused a great deal of trouble, and at last we discovered that from some cause or other, the salt that he used contained a good quantity of alum, and that is how the alum had got into the bread. There were 10 grains of alum in the 4-lb. loaf, in a bread that was perfectly innocent of alum added otherwise than in the salt. As regards the logwood process, I think it bears the same relation to the matter as the permanganate of potash bears to the detection of organic impurities in water. The logwood is a sort of indication, as has been said, that the bread is not exactly simple bread, composed of flour and yeast, and so on; and perhaps the logwood test is valuable as far as it goes. As for the process I published some years ago, I may say that I have departed from it since, and I now prefer the precipitation of the phosphates by an acid in the same way as has been mentioned.

Dr. TRIPE—It seems to me, Mr. President, that the chief value of the logwood test is—that if you do not get any colouration you go no farther; you do not trouble yourself to get out other results.

Mr. E. W. T. JONES—I have listened with very considerable interest to Mr. Wanklyn's paper, and to the remarks which have been made. I quite agree with Mr. Allen throughout: his remarks and his experience seem to corroborate mine absolutely. In the first place, as to the evaporation to dryness, I really do think that it is a necessity. As to the acid to be used I instituted a series of very careful experiments, and by using very strong sulphuric acid upon the ash of bread, and then heating until slight fumes were seen, and submitting it to a subsequent treatment for alumina, I was in no case able to find even a trace of alumina. I was not satisfied with the experiments as I had conducted them, but I ignited 200 grms. of bread, and I divided that ash into two parts approximately. I treated one with strong sulphuric acid, and heated it. I treated the other with hydrochloric acid, in the ordinary way. In one I obtained the alumina distinctly; in the other no trace of alumina could I detect. That clearly proved to me that it was not on ignition that I lost the alumina, although I candidly believe that unless great caution is taken—as Mr. Wanklyn observes—as to the lowness of the temperature, we lose alumina upon the ignition. As to Mr. Horsley's test, I have for some time relied upon the blue colouration, and I have never gone farther when I have found that there was no indication of the blue colour. But I should decidedly refrain from reporting any sample of bread from that test alone, and I should go farther into the matter. If I had a series of breads to test I should submit them all first to this test. I have satisfied myself that if there was no indication of colour I should not be wrong in passing them as not being aluminised; and if I got a blue indication I should go farther, and prove whether it was due to alum or any other cause.

Dr. STEVENSON—I, sir, can speak to the value of the method introduced by Dr. Dupré, especially with some modifications which he adopts which are not adopted by Mr. Wanklyn, particularly the re-solution of the precipitated aluminium and iron phosphate at first thrown down, and the subsequent treatment with pure soda from sodium, and its re-precipitation, which I almost invariably carry out—not exactly as Dr. Dupré does, but precipitating

the aluminic phosphate in soda, by means of acetic acid. The aluminic phosphate is thrown down by the addition of an acid. Of course it prevents the possibility of the phosphate of lime being thrown down with it. I must say, with regard to the fusion of the ash with an alkaline carbonate, I think that if you do not find any quantity of alumina in the solution obtained by hydrochloric acid it is unnecessary to fuse the ash with an alkaline carbonate. My own practice has been to obtain a solution in hydrochloric acid, and, if that contains any notable quantity of alumina, then to fuse the insoluble ash with carbonate of soda. I found, however, only very small quantities of alumina are contained in the insoluble portion of the ash, and if there is any alumina present at all, in the form of alum, you invariably get the major portion of it in the hydrochloric acid solution. I must also say that I agree with Dr. Dupré as to the quantity of alum, or rather alumina, which may naturally be found in bread and flour. I have found more than Mr. Allen finds. It is not always possible in these cases to obtain the flour from which the bread is made; but even in flour itself I have found larger quantities than he mentions, in cases in which I have been perfectly confident that there was no alum whatever in the flour. Moreover, with some of the coarser country flours, and breads made in the country, where there is less probability—from the dark colour of the bread—of its being alumed, I have found the quantity of alumina larger than in the whiter breads, which are more likely to be alumed. I think that by the use of this process the difficulties may be very greatly overcome. It only surprises one that the method is not popularly adopted. I find, however, very singularly, that the method of detecting alumina, and, I believe, of estimating alumina, by means of the phosphate, was first of all mentioned—many years ago—by a gentleman with whom I was a pupil; and I am very glad to mention it, because I observe that his son has been elected one of the associates here to-day. I refer to the late Mr. Nesbit. I believe that more than twenty years ago he proposed this method for the detection of alumina, and pointed out its extreme delicacy, though he had not developed it as Dr. Dupré has done.

Dr. DUPRÉ—There are just a few points I should like to mention. First of all, with regard to the volatilisation of alumina by sulphuric acid. I think, if it is examined, it will be found that the alumina is left in the residue. That very point led me to the adoption of my process. I had a loaf which I had not the least doubt contained alum, and I did not detect alum in the solution, using strong sulphuric acid as solvent. I fused the insoluble part with alkaline carbonate, and, to my great pleasure, I found alumina left behind with the silica. The alumina is nothing like so soluble in the strong sulphuric acid as it is in the moderately strong hydrochloric acid. And then, with regard to the volatilisation during evaporation, I have proved, I think satisfactorily, that nothing of the kind takes place. In my original paper will be found three experiments where I took equal quantities of alum. I estimated the alumina in one portion directly; I evaporated the other two portions no less than four times with an enormous excess of the strongest hydrochloric acid, and on then estimating the alumina I found absolutely not the slightest difference in the amount between these and the first portion. Therefore, I think, this fear may be very safely dismissed. Lastly, I would say that, like Mr. Allen, I made my loaves myself; I weighed the quantity of flour, and I weighed the loaf afterwards, and, of course, made my calculations on the entire loaf. A good many years ago, when this rage against alum in bread first came up, Dr. Odling and myself made a great many observations, amongst others, on grain grown at Rothampstead, and we found very distinct traces of alumina in every one of the samples; but the quantity was so small, when expressed in percentage, that ordinary analysis entirely overlooks it.

Mr. WANKLYN—To what percentage per loaf?

Dr. DUPRÉ—I cannot express it. It was easy to detect

it. I dare say in a 4-lb. loaf it would come to several grains of alum.

Mr. CLEAVER—I am afraid I can scarcely do more than corroborate the remarks already made. My process was estimating it as phosphate by means of hyposulphite of soda; and I think the only advantage is, that the hyposulphite which is precipitated is much more aggregated than the ordinary precipitate, and it can be weighed in a shorter time. You can precipitate it from the hyposulphite solution better than by using ammonia. At the end, the precipitate can be obtained in a more compact form, and be more easily weighed.

Mr. WIGNER—I have for a long time used Dr. Dupré's process in the examination of bread, but I was once caught by a sample of bread which necessitated a modification of it. I had an adulterated sample which contained more than 100 grains of alum in the 4-lb. loaf calculated as alum. The phosphate present in the bread was not sufficient, and this led me always since to add a small quantity of phosphate of ammonia, which insures precipitation of the alum. I can also corroborate Dr. Dupré's figures, in reference to the amount which I have found present as the maximum in a pure bread. In pure bread or pure flour, calculated in the same proportion, the maximum I have found has been 8 grains of alum in the 4-lb. loaf, and that is the number, therefore, which I am in the habit of deducting in all my analyses.

Mr. WANKLYN—I should like to say a few words in reply. With regard to the way I alumed the bread upon which I operated, this was the process. The hundred grammes of bread was put into the platinum dish, and then the solution containing the alum was dropped on to the bread, so that there could be no doubt whatsoever of the quantity of alum that I had in that very sample of bread. That seemed to me the most satisfactory way of obtaining samples containing a known quantity of alum. With regard to the weighing of the bread ash, one of the reasons for weighing it is that it is well known that when bread is kept it alters in condition. It becomes slightly drier, and the question is sometimes asked, "Have not you operated upon exceedingly dry bread, and did not you over estimate the alum in the bread?" Now, if you take the trouble to weigh the ash, you will be able to answer that question. With regard to the solubility of silica, my reason for discarding the operation to dryness was simply this. I adopted the process, and I found that I did not get more silica when I evaporated to dryness than when I did not evaporate to dryness, and that is a very good proof that the evaporation was unnecessary. As will have been observed, I preferred to weigh the silica. The object of weighing the silica is that you are able to say absolutely whether you have or have not left any phosphate of alumina behind. If you have left phosphate of alumina undissolved, you will find it along with the silica, and the silica will be in excess. With regard to the subsequent treatment: the process that we have to adopt should be simple, and it is of the utmost importance to avoid the use of an extra reagent if you can. As will have been observed, the only reagents that I employ are hydrochloric acid, ammonia, and acetic acid. All of them are volatile substances, and, by simply ascertaining that you get no residue, you will be sure that there can have been no alumina in your reagents. As regards the volatility of chloride of aluminium, my process does not touch the question. But it is well known that, if there be traces of moisture present, there is no volatilisation. With regard to the desirableness of separating the iron I make no separation of the iron, I weigh the precipitate: then I dissolve up in hydrochloric acid, and gauge the colour of the solution. It is now pretty well known that you can determine iron volumetrically by the colour. A short time ago there was a paper in the CHEMICAL NEWS, by Mr. Carnelley, giving a description of the process. I have gone over the process, and I can confirm completely everything that he has said about it. It is a most delicate process, and exceedingly simple. Well

then, if you can so easily determine the iron, if you have merely to dissolve up your precipitate, dilute, and put in a little ferrocyanide of potassium, why should you go to the trouble of making the separation?

Some other papers read at the meeting will be reported in our next issue.

CORRESPONDENCE.

RATIONAL FORMULÆ OF MORPHINE AND CODEINE AND THEIR DERIVATIVES.

To the Editor of the Chemical News.

SIR,—In CHEMICAL NEWS, vol. xxxi., p. 47, is a paper by Mr. S. E. Phillips, entitled "On a Study of Condensation Radicals," in the course of which the author inquires why morphine and codeine should be regarded as diamines rather than as ammonias; or, in other words, why the rational formulæ attributed to these bases should be not identical with the empirical formulæ, but multiples thereof. As similar questions have been asked by others, in reference to those morphine and codeine derivatives which I have provisionally regarded as polymerides, perhaps it may not be out of place to review here the evidence (such as it is) on which these conclusions are based, merely premising that this evidence is to be found interspersed through a series of (at present) seventeen papers communicated during the last six years to the Royal and Chemical Societies by myself, partly in collaboration with the late Dr. A. Matthiessen, and with Herr Ludwig Mayer and Mr. G. H. Beckett.

First, as to morphine and codeine. By the action of various reagents on these natural alkaloids, products can be formed the composition of which cannot be expressed by formulæ including a less number of N symbols than 2; of these products, most, if not all, can be re-transformed into the original alkaloids, thus proving that no polymerisation has taken place in the formation of these products, since, so far as I know at present, it is impracticable to obtain ordinary morphine and codeine from their respective polymerides. Hence it results that the formulæ of the alkaloids must be written as containing the N symbol at least twice, the argument being precisely analogous to that which proves tartaric acid to be bibasic, or that which fixes the formula of quinine as $C_{20}H_{24}N_2O_2$, instead of the half of this. Amongst such products may be included the following bases:—

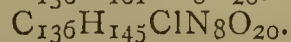
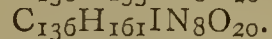
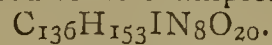
$C_{34}H_{37}ClN_2O_5$.
 $C_{34}H_{37}(C_2H_3O)N_2O_6$. .. Mono-acetyl morphine.
 $C_{34}H_{36}(C_2H_3O)(C_4H_7O)N_2O_6$. Acetyl-butyryl morphine.
 $C_{36}H_{43}ClN_2O_6$.
 $C_{36}H_{43}BrN_2O_6$.

It is perfectly true that in several cases neither the base itself nor its salts have as yet been obtained crystallised. This objection to the homogeneity of the products, however, does not apply in all cases, *e.g.*, acetyl-butyryl morphine. Moreover, the assumption that these products are mixtures in equivalent quantities of morphine or codeine and a derivative of N_1 formula, is rendered highly improbable, by the behaviour of the substances with solvents, by the impracticability of separating any given product into two dissimilar constituents by the mixture of which the product can be re-formed, and by the circumstance that it is not one or two instances only that have to be dealt with, but several; so that the chance of several products being in each case mixtures of exactly equivalent quantities of two dissimilar bodies is very small.

Next, as regards the morphine and codeine "polymerides." By acting on morphine or codeine with various agents known to produce polymerising effects on other substances, a series of products are formed isomeric with the original bases, and exhibiting progressive differences in physical, chemical, and physiological action. Amongst such differences may be noticed progressive insolubility in various menstrua; progressive difficulty in crystallisation;

progressive diminution in antacid characters, and in the power of receiving additive hydrogen from hydriodic acid: differences in the form in which nitrogen is evolved during certain reactions; &c.

A priori, the explanation of these results by supposing polymerisation to take place appears at least reasonable; and this view is confirmed by the circumstance that in numerous instances derivatives are obtainable from these polymerides the formulæ of which cannot be written as containing less than 4, 6, or 8 N symbols. Hence, formulæ which are multiples by 2, 3, and 4, respectively, of the formulæ of morphine and codeine are attributed to the respective members of these series of products. Not to take up space unduly, the following N_8 derivatives of the "tetra" series may be referred to as examples:—



In addition to these, numerous "tetra" derivatives are known the formulæ of which cannot possibly be written as containing less than 4 N symbols.

The same kind of objections and counter-arguments adduced above in reference to the ordinary (mono) codeine and morphine derivatives apply in these cases. It is not, as some have supposed, on the mere production of one or two non-crystalline, and possibly non-homogeneous, substances that the multiple formulæ are based; but on the existence of *many* derivatives of the kind referred to above, and chiefly on the consentaneous agreement of a large number of circumstances, none of which have any great weight by themselves, but which jointly are of considerable weight.

I do not pretend to have demonstrated beyond possibility of doubt the correctness of the views concerning morphine and codeine and their derivatives, to which my experiments have led me; but I may affirm that these views afford a clearer explanation and co-ordination of the observed phenomena than any others that have as yet presented themselves to me, whilst there is nothing contrary to analogy or otherwise unreasonable in them.

If I understand Mr. Phillips's last paper aright (and I am not sure that I do, owing to the somewhat *bizarre* notation which he affects), he contends that true polyamines are normally mono-acid, and that, therefore, such salts as those formed by the codeine and morphine polymerides are of exceptional character. In truth, however, polyamines are by no means always mono-acid; and, indeed, as a rule, the maximum acid-combining power of such bodies is usually equal to the number of N symbols in their rational formulæ, although a lesser acid-combining power may be sometimes manifested. Thus quinine can be either mono- or di-acid; ethylene-diamine, and analogously constituted bodies are di-acid (sometimes mono-acid also); the poly-ethylen-triamines can be mono-, di-, or tri-acid, as can also rosaniline and its phenyl, ethyl, &c., derivatives, or its homologues; the poly-ethylene-tetramines exhibit a maximum acid-combining power of 4, and so on; so that, so far from being exceptional, the salts of the morphine and codeine polymerides are quite normal, in that each of the bases fixes as many equivalents of acid or of ethyl-iodide as is indicated by the number of N symbols in the rational formula.

In conclusion, I cannot help expressing my regret that Mr. Phillips does not see his way to add greatly to the utility (not to say intelligibility) of his numerous and most laborious essays on theoretical chemistry by adopting the simple, and in many respects convenient, notation now generally used; this being based purely on experimental grounds and a few arbitrary, but convenient, conventions, and being wholly separable from any hypothesis, offers many advantages not possessed by the older systems of notation, in so far as it expresses clearly enough a large number of facts and relationships; whilst the objections that apply to the modern notation are equally applicable to the older ones, with the additional objection that the older systems are not only incapable of representing many

facts connoted by the newer one, but even sometimes misrepresent facts and are thus apt to lead to the drawing of false conclusions.—I am, &c.,

CHARLES R. ALDER WRIGHT, D.Sc.

Chemical Laboratory, St. Mary's Hospital, W.,
February 1, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 2, January 11, 1875.

Action of Electrolytic Oxygen on Vinic Alcohol.—M. A. Renard.—When vinic alcohol, mixed with about 5 per cent of water acidulated with one-fourth of sulphuric acid, is submitted to the current of four or five Bunsen elements, there is observed an abundant escape of hydrogen gas at the negative pole, whilst at the positive pole no gas is disengaged, the oxygen being consumed in oxidising the alcohol. After forty-eight hours, when operating upon about 100 c.c. of a mixture of alcohol and acidulated water, the experiment is concluded. The liquid has a faint amber tint. If distilled, it begins to boil at 42° to 43° , and its boiling-point gradually rises to 80° C. The distillate, treated with chloride of calcium, sends up to its surface a liquid of a powerful odour, the quantity of which increases on adding water to the saline mixture. If the liquid is submitted to fractional distillation, it yields formiate of ethyl mixed with aldehyd, and a large quantity of acetate of ethyl; but, besides these products, there are formed acetal, and a new body—monoethylate of ethylden. These two compounds, in spite of their elevated boiling-points (88° to 90° and 104°), are nevertheless found among the first portions which distil over, by reason of their small proportion.

Stratified Light.—M. Neyreneuf.—The author, after referring to his former researches (*Comptes Rendus*, lxxviii., p. 950), undertakes to show that a regular system of oscillations is not incompatible with the propagation of a rapid flow of light and heat, capable of energetic mechanical action. The combustion of a detonating mixture is effected in a cylindrical vessel, submitted at its two extremities to the inverse actions of the positive and negative fluids: and if the successive layers receive a regular vibratory movement from the combination of the first portions of the mixture, it is clear that the flame will heat certain parts of the tube more slowly than others. If we operate with a mixture of hydrogen and oxygen, the watery vapour formed will condense by preference on the latter parts, and will thus prove that, notwithstanding the violence of the shock, the flame vibrates as it is propagated along the tube.

Specific Rotatory Power of Mannite.—M. G. Bouchardat.—The author has proved that all the derivatives of mannite which he has had the opportunity of examining, possess specific rotatory powers of variable amount, sometimes to the right and sometimes to the left. In studying these phenomena, he finds that mixed solutions of mannite and borax were unsuited to decide the question of the rotatory power of the former. There are formed, under such circumstances, true compounds, in which the properties of borax and those of mannite are completely masked. A mixture of these two bodies in equal equivalents remains soluble in water in all proportions. This liquid, unlike the solutions of borax, is not precipitated by the addition of a soluble salt either of lime or baryta. Solutions of mannite dissolve the biborate of lime, a body insoluble in water, in equivalent proportions. From the compound formed, mannite can only be extracted by

treating it with a powerful acid, and extracting the residue with absolute alcohol, which removes the boracic acid. It turns the plane of polarisation strongly to the right. The specific rotatory power of the mannite in this combination = $+28.6$. Lastly, a capital point, if we observe solutions of mannite containing variable proportions of dissolved borate of lime, the deviations observed are sensibly as the weight of the borate in solution. On determining the rotatory power of mannite dissolved in water, the result was $[\alpha]_D = -0^{\circ} 15'$. Mannite is therefore an active substance having a very slight rotatory power to the left, *i.e.*, in the opposite direction to what had been concluded from experiments made with the aid of borax.

Annalen der Physik und Chemie, von Dr. J. C. Poggen-dorff, No. 7, 1874.

The Elasticity of Rods of Calcareous Spar.—G. Baumgarten.—An account of experiments undertaken to determine the elasticity of crystalline bodies, calcareous spar being selected for the sake of convenience. The results may be summed up as follows:—The bending of a rod is independent of the position of the lateral plane; it depends on dimensions in the same manner as in non-crystalline bodies, being directly proportional to the cube of the length, and indirectly proportional to the cubes of the breadth and thickness. There is no symmetry towards the principal axis. The minimum bending is in the direction of the corners, and the maximum in the short rhombus diagonal. It appears that all the planes of a rhombohedral primary form are tangents of the superficies of deflection along a curve. The deflections are not proportional to the weights, and the increase of the deflections becomes smaller when the weights are greater. It appears as if the linear differential equations of elasticity lost their validity in case of crystals.

Reflection of Light on the Surface of Isotropic Bodies.—G. Lundquist.—Not adapted for abstraction.

Studies on the Measurement of Terrestrial Magnetism.—Karl Braun.—(A continuation from No. vi.) This portion of the memoir treats of the determination of declination by means of the inclinatorium.

Thermo-Electricity.—Professor P. G. Tait.—From *Nature*.

Determination of the Absolute Number of Vibrations of a Note, and on the Dependence of the Height of a Note on Amplitude.—F. Poske.—A paper on acoustics: not adapted for abstraction.

Behaviour of the Hemi-Sulphide of Copper with a Solution of Nitrate of Silver.—R. Schneider.—As regards the monosulphide it seems beyond all doubt that in contact with solutions of nitrate of silver it is simply resolved into sulphide of silver and nitrate of copper. As regards the hemi-sulphide, the author could find no indications. It appeared, indeed, probable that the two compounds would be decomposed according to the equation, $\text{Cu}_2\text{S} + 2(\text{Ag}_2\text{N}_2\text{O}_6) = 2(\text{CuN}_2\text{O}_6) + \text{Ag}_2\text{S} + 2\text{Ag}$. The author found an experimental proof as follows:—0.2 gm. of very pure and finely powdered copper-glance were put in a stoppered flask along with a standard solution of nitrate of silver (0.010 gm. Ag in 1 c.c.), and subjected to continual agitation. When silver could no longer be recognised in a drop of the clear liquid, more silver solution was added until the clear liquid, after long standing, gave a faint reaction of silver, which ensued when 54.5 c.c. of the solution had been used. According to the above equation, 54.32 c.c. should have been consumed. The solution had a pale blue colour, and contained, besides the slight excess of nitrate of silver, merely nitrate of copper. It was perfectly free from sulphuric acid. The sediment when well washed was a dense, grey, crystalline, granular powder in which paler whitish particles could be plainly distinguished from others of a black colour. On treatment with nitric acid of sp. gr. 1.18, a part—metallic silver only—was dissolved with evolution of nitric oxide, whilst a homogeneous black

powder remained, having the properties of silver sulphide. Quantitative determinations proved the correctness of the above-given equation.

Remarks on the Meteorological Memoir of H. Budd.—R. Clausius.

Formation of Valleys of Glaciers.—Alex. Müller.

Rolled-Stone Ridges.—Alex. Müller.

Electrolytic Preparation of Magnets.—W. Beetz.—The author maintains, in opposition to the late Professor Jacobi, that permanent magnets may be formed by the electrolytic deposition of iron, if care be taken that the deposit is homogeneous, which may be effected by the presence of sal-ammoniac in the solution.

What Rays of Light Decompose Chlorophyll in Presence of Oxygen.—Julius Wiesner.—The author's experiments, in common with those of other observers, lead to the view that all the chemical processes connected with light in the chlorophyll granule, *i.e.*, production and decomposition of chlorophyll, and assimilation of carbonic acid and of water, are produced most rapidly by the most luminous rays; and all the visible portions of the spectrum have the power of exerting this function. The mechanical effects produced by light in plants may be chiefly ascribed to the so-called chemical rays of light.

Simple Eye-Piece Spectroscope for Stars.—F. Zöllner.—Not intelligible without the accompanying illustration.

Number of Images in Two Plane Mirrors Inclined Towards Each Other.—Dr. H. Klein.—A mathematical paper, unfit for abstraction.

Remarks on the Electrical Machine.—J. C. Poggen-dorff.—The author finds, in opposition to the theory of Veltmann, that a plate of thick glass in the machine of Holtz is not less efficacious than a thin plate.

No. 8, 1874.

Experimental Investigations on Electric Vibrations.—N. Schiller.—A lengthy paper; not adapted for abstraction.

Reflection of Light on the Surface of Isotropic Bodies.—G. Lundquist.—(Conclusion.) The author treats in this portion of his memoir on the reflection of light on imperfectly transparent non-metallic bodies.

Terrestrial Magnetic Measurements.—K. Braun.—This section contains directions for the determination of intensity by means of the inclinorium, and remarks on measurements with the magnetometer.

The Magnetising Function of a Ball of Soft Iron.—Dr. C. Fromme.—Not adapted for abstraction.

Crystals of Glycerin.—V. von Lange.—The examination of these crystals was attended with difficulty, as when taken out of the mother-liquor they melt away, and render the application of the reflecting goniometer impossible. They belong to the rhombic system; their elements are $a:b:c=1:0.70:0.66$; the forms are 100, 011, 101, 111. Cleavage imperfectly perpendicular to the longitudinal axis, therefore parallel to a plane 010.

Reply to the Remarks of H. Herweg on the Essay "On the Nature of Electricity."—E. Edlund.—The author refers to his work, "Théorie des Phénomènes Electriques." Stockholm: Norstedt et Söner.

Rotatory Power of the Hyposulphites.—An extract from *Comptes Rendus*, lxxvii., p. 1839.

Trinity College, Dublin.—The Board has appointed Dr. J. Emerson Reynolds to the University Professorship of Chemistry in Trinity College, Dublin. This appointment renders vacant the Professorship of Chemistry in the Royal College of Surgeons, and the Professorship in the Royal Dublin Society.

MEETINGS FOR THE WEEK.

SATURDAY, Feb. 13th.—Physical, 3. (Annual Meeting.)

MONDAY, Feb. 15th.—Medical, 8.

— London Institution, 5.

— Society of Arts, 8. (Cantor Lectures.) Rev. Arthur Rigg, M.A., "The Material, Construction, Form, and Principles of Tools and Contrivances used in Handicraft."

TUESDAY, 16th.—Civil Engineers, 8.

— Royal Institution, 3. E. Ray Lankester, M.A., "On the Pedigree of the Animal Kingdom."

— Zoological, 8.30.

WEDNESDAY, 17th.—Meteorological, 7.

— Society of Arts, 8. M. Dunant, "Description of M. Kastner's New Musical Instrument, the Pyro-phone."

THURSDAY, 18th.—Royal, 8.30.

— Royal Institution, 3. Professor Tyndall, "On Subjects Connected with Electricity."

— Royal Society Club, 6.30.

— Chemical, 8. Professor Clerk Maxwell, F.R.S., "On the Dynamical Evidence of the Molecular Constitution of Matter."

FRIDAY, 19th.—Royal Institution, 8. Weekly Evening Meeting. Professor Frankland, "On River Pollution." 9.

— Society of Arts, 8. (Chemical Section.) W. N. Hartley, F.C.S., "On Air and Ventilation."

SATURDAY, 20th.—Royal Institution, 3. Mr. J. T. Wood, "On the Discovery of the Temple of Diana, and other results of the Government Excavations at Ephesus."

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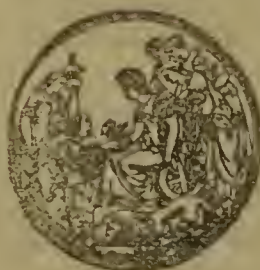
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THE CHEMICAL NEWS.

VOL. XXXI. No. 795.

OBSERVATIONS ON THE PRODUCTION OF NITROUS ETHER BY MEANS OF SULPHOVINIC ACID.

By Dr. T. L. PHIPSON.

A METHOD for the production of various ethers has recently been put forth by M. Champion, in which the corresponding ether-sulphuric acid is made use of. For instance, ethyl-sulphuric acid is introduced slowly into a mixture of 2 parts of concentrated sulphuric acid and 1 part of nitric acid, the vessel being kept at the ordinary temperature of the air. In the course of half-an-hour, according to the author, the liquid becomes cloudy, and the nitrous ether rises, and may be decanted off.

This method may apply tolerably well to such as the ethylic alcohol, and as applied to alcohols of high atomic weights I think it is not precisely new. With regard to ethylic alcohol, I am of opinion that the process is full of danger.

Having adhered as closely as possible to the proportions indicated by the author named, I have invariably found that *nitric* ether is readily formed, not in the course of half-an-hour, but in the space of a few minutes only, and that, however slowly the sulphovinic acid is introduced into the mixture of sulphuric and nitric acids* (surrounded by cold water), and however quiet the reaction appears, there comes a moment when, without the slightest apparent cause, the whole decomposes with production of great heat and volumes of nitrous vapour, the liquid frothing up suddenly to twelve or fourteen times its original volume.

So intense is the reaction, that if the operation were conducted with large quantities of material in the hands of a manufacturer, it would probably have very serious consequences.

ON A NEW PROCESS FOR PRESERVING WOOD FROM FIRE AND DECAY.

By S. W. MOORE.

It has been the endeavour of chemists for some long time to discover a means whereby wood could be preserved from decay and protected from fire without increasing its cost or otherwise materially altering its general properties.

The following process, devised by Mr. Weatherby and investigated by myself, seems to be one which shall meet these demands to a remarkable degree:—

The wood to be prepared is first kiln-dried, which process deprives it of all moisture and much of its volatile turpentine and other inflammable matter; it is then put into suitable cylinders, in which lime and water with sulphurous acid gas are forced into the pores of the wood under considerable pressure, the sulphurous acid being a by-product from the wasting of pyrites.

The wood is removed and dried, and is then ready for use.

When sulphurous acid is passed into lime under pressure, a sulphate of lime is formed which is soluble in water, capable of crystallising as a bisulphite, which is readily oxidisable and convertible into sulphate of lime or gypsum.

As this is an exceedingly insoluble salt, it is not easily removed, therefore, from the pores of the wood, and not only protects the wood by its presence as a non-conductor

* If the mixture is made in the reverse manner, decomposition ensues at once, as each drop falls.

of heat, but deoxidises all matters which are likely to prove objectionable as ferments.

The advantages presented by this wood are that its weight is less after treatment than of the same wood before kiln-drying; a series of pieces gave a mean specific gravity of 0.3501. The process for working is very much cheaper than that of any other yet devised; it is an admirable means for preventing dry rot and decay from the action of water, as its pores are coated with an insoluble salt; it thus wears longer and vibrates less than ordinary pine; it resists the attacks of insects, and from the removal of the volatile inflammable matter, as well as from the introduction of a non-conducting material, it is well able to withstand fire, the interior parts not giving up gaseous matter, which always so readily inflames.

The wood, although answering these ends, contains but little matter foreign to itself.

Woody fibre	87.2
Moisture at 115° C.	8.5
Ash	4.3
	<hr/>
	100.0

The idea here presented is much the same as that noticed accidentally in the late Franco-Prussian war: many houses there were found to have been protected from fire when they were largely built with plaster; lath and plaster walls were absolutely uninjured by the fire when surrounding parts were destroyed.

St. George's Hospital, S.W.

THE NEW DYES OF CROISSANT AND BRETONNIERE.

By ADOLPHE OTT.

A RECENT number of the *Bulletin of the Industrial Society of Mulhouse* brings a very interesting report on these dyes, from which we gather that a special committee has been investigating them in order to ascertain their value for the various purposes of dyeing and printing. At first the great durability of these colours engaged the attention of the members of the committee. Ink spots could, for instance, readily be removed by means of oxalic acid without the dyes themselves being changed in the least. Their exceptional affinity for the fibre was illustrated by the fact that they adhered without heating the dye-bath. It is preferable, however, to use a warm bath, one of +60° C., for instance. As mordant, bichromate of potassa may be most advantageously employed; different metallic salts yield various shades. The committee discovered further that the dyeing takes place with great regularity, and is not attended with any inconvenience such as may result with other colours from the presence of dirt on the fabric or want of sufficient bleaching.

With regard to the durability, it is stated to be of a very extraordinary kind. The sunlight, as far as observations go, seems not to exert any influence on these colours; boiling soap-solution and oxalic acid are without effect, only chlorine or hypochlorites affect or rather destroy them. According to the opinion of the committee, the shades produced by the new dye stuffs can also be obtained by the old dyes, but less easily, and they are less durable, and more expensive. Printing trials were instituted with four different colours, first with one that had been thickened with dextrine and lerocome, then with precipitated colour. The latter had been obtained by decomposing the commercial product (which in any case is the alkaline salt of a mercaptic acid, *vide Berich. der Deutsch. Chem. Gesell.*, No. 16, 1874, page 1530) by means of an acid; the precipitate was washed well, and again dissolved in caustic soda. Whether now the original colour was employed, or the one obtained in the manner indicated, it was (according to the report) mostly fixed during

printing; by steaming fixation was rendered more complete; the application of bichromate of potassa, however, was not necessary. If the shades obtained by dyeing are combined with those produced by printing, articles with two and three colours can be obtained.

The samples annexed to the *Bulletin* are of great beauty, and show that much can be accomplished with the new dyes that hitherto was only possible to achieve by means of the Jacquard-loom, owing to the fact that the designs show very sharp outlines, and that the colour impregnates the whole tissue.

The opinion is summed up in the following:—"The durability of the new colours confers on them an incontestable interest, and, owing to the facility with which they can be fixed, it may be expected that they will find application for certain simple goods of which great durability in colour is demanded."

With regard to the prices of the new colours, they vary from 2½ marks (1 m. = 1 sh.) to 8 marks per kilo.; the principal shades are grey, grey-brown, dark-brown, brownish-yellow, and yellow. They are at present manufactured in Goettingen and Frankfort-on-Maine.

Frankfort-on-Maine,
Feb. 8, 1875.

NEW METHOD OF QUANTITATIVE ANALYSIS OF ORDINARY ALLOYS.

By SERGIUS KERN, St. Petersburg.

THE complicated nature of the quantitative analysis of several of the best known metallic alloys demands from the operator great practice and knowledge. With the view of facilitating the labours of the operator, I annex a description of my method, which is founded on the law of reduction of metallic salts by metals, and may be applied to silver, lead, and copper alloys.

Silver Alloys.

Standard alloys of silver and copper.—English silver coin contains 92.5 per cent Ag;—French, German, Austrian, 90 per cent Ag.

Hard Silver Solder.—80 per cent Ag, 20 per cent Cu. By this method of analysis silver nitrate (AgNO_3) may be assayed; sometimes adulterated with potassium nitrate (KNO_3), which decreases the worth of this silver salt, so much used in electro-silvering and photography. The pure salt contains 63.5 per cent of silver. 1 gm. of filings from the coin or alloy to be analysed is dissolved in nitric acid. The whole of the solution is then carefully poured into a test-tube, and a clear copper rod is then hung in the solution. The reduced silver received is washed, dried, and weighed. Suppose, 0.4 gm. of silver is received; hence $1:0.4=100:x=40$ per cent. The analysed alloy contains 40 per cent silver. If in assaying 1 gm. of AgNO_3 , 0.5 gm. of silver was received, then $1:0.5=100:x=50$ per cent. The analysed salt contains 50 per cent silver.

Lead Alloys.

Group I.—Alloys of Pb (lead) and Sn (tin). Iron solder: 50 per cent Pb, 50 per cent Sn; tin solder: 66 per cent Pb, 34 per cent Sn; tin solder, coarse: 75 per cent Pb, 25 per cent Sn. 1 gm. of the alloy is dissolved in nitric acid. The metastannic acid is filtered from the solution of lead nitrate, and boiled with hydrochloric acid. The stannic chloride (SnCl_4) received is reduced in metallic state by a rod of clean zinc; the solution of SnCl_4 must not contain free nitric acid. 0.25 gm. of tin is received: $1:0.25=100:x=25$ per cent of tin; the percentage of lead is calculated by reducing the lead salt by a zinc rod.

Group II.—Alloy of lead and Sb (antimony). Printing type metal: 75 to 80 per cent Pb, 25 to 20 per cent Sb. 1 gm. of the alloy is dissolved in nitric acid. The solution containing lead nitrate, and a precipitate of

meta-antimonic acid (HSbO_3) is filtered, and the precipitate is dissolved in strong hydrochloric acid. The antimony trichloride (SbCl_3) received is reduced in metallic state by a rod of clean zinc. The antimony received in a state of grey powder, and the lead obtained by reducing the nitrate of lead in solution by zinc, are weighed, and the percentage of metals in the alloy is calculated as mentioned above (see Group I).

Copper Alloys.

Group I.—Alloys of Cu (copper) and Sn (tin). Bronze: 70 per cent copper, 30 per cent tin; speculum-metal: 66.6 per cent Cu, 33.3 per cent Sn; gun-metal: 90 per cent Cu, 10 per cent Sn; bell-metal: 80 per cent Cu, 20 per cent Sn. 3 grms. of the alloy are dissolved in nitric acid. The solution containing copper nitrate and metastannic acid is filtered, and a clean iron rod is hung in the solution. The metastannic acid is reduced as mentioned above. The received metals, copper and tin, are weighed. Suppose we received 2 grms. of copper and 1 gr. of tin: $3:2=100:x$; $x=66.6$ per cent copper; $3:1=100:x$; $x=33.3$ per cent tin.

Group II.—Alloys of Cu (copper) and Zn (Zinc). New gold (semilor): 88 per cent Cu, 12 per cent Zn; tombac or pinchbeck: 85 per cent Cu, 15 per cent Zn; yellow brass: 66.7 per cent Cu, 33.3 per cent Zn; Muntz's metal: 60 per cent Cu, 40 per cent Zn; medal-metal: 92.6 per cent Cu, 7.4 per cent Zn; good soldering brass: 72.7 per cent Cu, 27.3 per cent Zn; hard copper solder: 75 per cent Cu, 25 per cent Zn; soft copper solder: 50 per cent Cu, 50 per cent Zn. The alloy is dissolved in nitric acid, the copper is reduced, and the percentage is calculated as mentioned above. The remainder will be the percentage of zinc, which is tested in the usual manner.

Group III.—Alloys of Cu, Sn, and Zn. Soft brass for castings: 84.2 per cent Cu, 10.5 per cent Sn, 5.3 per cent Zn; hard brass for castings: 79.4 per cent Cu, 14.3 per cent Sn, 6.3 per cent Zn; tube copper: 87.8 per cent Cu, 2.5 per cent Sn, 9.7 per cent Zn; brass for turning: 73.5 per cent Cu, 4.6 per cent Sn, 22.9 per cent Zn. The alloy is dissolved in nitric acid; the solution containing nitrates of copper and zinc, and a white precipitate of metastannic acid, is filtered. The nitrate of copper and the metastannic acid are reduced into metallic state as mentioned above, and the received metals are weighed. Suppose, in assaying 12 grms. of the alloy, 9 grms. of copper, and 2.5 grms. of tin were received; hence: $12:9=100:x=75$ per cent copper; $12:2.5=100:x=20.8$ per cent tin; the remainder, 4.2 per cent, is zinc, which can be tested in the usual manner.

I confined myself entirely to experiments on the above mentioned alloys which are most in use, but gave much attention to the analysis of silver alloys. By my method, analyses of alloys may be made without having recourse to the extensive and costly apparatus demanded by the process now in use.

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, December 29th, 1874.

E. W. BINNEY, F.R.S., F.G.S., Vice-President, in the
Chair.

"On a case of Reversed Chemical Action," by JAMES
BOTTOMLEY, B.Sc.

Having observed the solubility of iodine in a solution of borax, an experiment was made to see what the result of this solution would be, expecting to obtain a combination of soda with excess of acid. 27.8475 grms. of borax were dissolved in about 250 grms. of water. As it was difficult

to anticipate what the action of the iodine might be, this element was added at hazard, the quantity used being nearly 7 grms. When assisted by heat almost the whole of this quantity dissolved in the solution, only a small quantity evaporating along with the aqueous vapour. The solution, which amounted to about 200 c.c., had only a faint yellowish tint. Being set aside for some days, it deposited crystals which proved to be ordinary borax, for 0.5932 grm. of the crystals lost by heating 0.2773 grm. of water of crystallisation corresponding to 46.75 per cent, the theoretical quantity being 47.13. After removing the crystals the solution was still further evaporated in a retort. As the evaporation proceeded, instead of the faint yellow tinge disappearing as was anticipated, the colour of the solution began to darken, finally becoming opaque owing to the quantity of free iodine in solution; vapours of iodine were also given off along with the steam. Thus the iodine which had previously dissolved and chemically united with the soda when the solution was dilute, was displaced and eliminated in the free condition when the mixture was past a certain degree of dilution. The explanation of this reversal of chemical action is as follows. When sodic borate is diluted with water its constituents are so far dissociated that the iodine acts towards the soda in the same way as it would towards caustic soda, sodium iodide and sodium iodate being the result. When, however, the solution is concentrated the boracic acid, notwithstanding its feebly acid power, is able to displace continuously and simultaneously small quantities of iodic and hydroiodic acid from combination with sodium, but these two acids cannot co-exist in the free state; by mutual reaction they give iodine and water. To test the correctness of this explanation the following experiment was made. Boracic acid was added to a solution of sodium iodide; even after boiling some time the solution only acquire a feeble yellow tint, and no iodine vapours were given off; but on the addition of sodium iodate the solution soon became dull brown owing to the presence of free iodine, which also was given off along with the steam. This behaviour of iodine with sodic borate favours the view of the decomposition of the salt by dilution; it also shows the varying character of chemical affinity under different circumstances of temperature and dilution.

GLASGOW PHILOSOPHICAL SOCIETY:
(CHEMICAL SECTION).

Ordinary Meeting, February 1st, 1874.

J. J. COLEMAN, F.C.S., in the Chair.

Mr. JAMES MACTEAR, St. Rollox Chemical Works, made a short communication on "Flue-testing," promising to consider the question at greater length at a subsequent meeting. He said that the speeds of flues varied very much in all directions, vertically, horizontally, and longitudinally, and that the speed in the longitudinal direction had of late become a most interesting matter, owing to the hard and fast line which had been established by the Alkali Act, which rendered it imperative that not more than 5 per cent of the muriatic acid gas produced should be allowed to escape into the air. But the chemists in alkali works had now got a difficult nut to crack, inasmuch as the amended act stipulated that not more than one-fifth of a grain of pure hydrochloric acid for every cubic foot of air should be emitted at the top of the chimney. The Inspector had been asked to say where the samples of the gas were to be taken for testing, as it was quite impossible that the top of a very high chimney could be resorted to for the samples. That was certainly the best place for obtaining the most complete mixture of the escaping gases, but it was quite impracticable. At all other places eddies had been detected which were due to a number of varying conditions.

Mr. MACTEAR afterwards gave a description of appa-

ratus which had been designed to show how hydrochloric acid gas might be distributed either into one or two condensers as might be found desirable. It is essentially a valve or damper fixed on the top of the salt-decomposing furnace, and consists entirely of stone and earthenware pipes, water being used as the luting or actual damper. There is no iron or other metal work about it. The apparatus is attached to a new double furnace at the St. Rollox Chemical Works, which is so very large that by this new arrangement, it is capable of doing three times the amount of work done by an ordinary decomposing furnace.

The apparatus was highly commended for its ingenuity and serviceableness by several speakers, and it was urged that the notice of it which would doubtless appear in the Society's "Proceedings" should be accompanied by an illustration of the damper and its connections.

Dr. JAMES MILNE then read a paper "*On the Presence of Lead and Copper in Aerated Waters.*" He had found, he remarked, that some medical men in Glasgow were of opinion that lead in soda-water was not poisonous, and only recently he had had a conversation with one gentleman, who informed him that he considered the cry which had been lately raised a piece of nonsense; that lead was only poisonous when it accumulated in the system; and that, as it was sort of mild purgative, especially when taken in the morning, lead in soda-water never so accumulated. Some time ago Dr. Wallace called attention to the presence of an alarmingly large amount of lead in a sample of aerated water submitted to him for examination, and since then the whole subject had been pretty freely discussed. The presence of this metal was clearly traced to the employment of lead pipes in the machines used for the preparation of such waters, there being no doubt that water charged with carbon dioxide acts somewhat strongly on metallic lead, giving rise to the formation of carbonate of lead, which, though insoluble in water, is then held in solution, most probably as "bicarbonate," just as we find calcium carbonate dissolved in natural waters. As a result of the discussion, the use of such leaden pipes had been discontinued by the majority of the local manufacturers, pipes of block-tin being in most cases substituted, whilst, in a few cases, he believed earthenware pipes had been used. To the use of pipes made with the purest virgin tin no serious objection could, he thought, be made, except perhaps, the difficulty, in some cases, in getting them, and their high price. But it must be borne in mind that ordinary block-tin often contained appreciable quantities of lead, and that earthenware pipes, besides being very difficult to make of the forms necessary for most aerated-water machines, were also very liable to fracture. He had with him a specimen of a lead pipe taken from a soda-water machine, after being about three months in use, which quite disposed of the question of the action of aerated water on lead. Anyone acquainted with plumber work would easily understand the corrosive action which had taken place in this case—the original pipe as put into the machine being something like double the thickness of the specimen exhibited. While, however, the lead difficulty was being got over, there was another source of danger which he wished to bring under the notice of the Section, and one which, from a medical point of view, was probably of more importance than the presence of small quantities of lead—he referred to the presence of copper in such waters. The source of this contamination was, of course, easily traceable to the use of copper cylinders in the manufacture of the waters. Of course, the cylinders were previously tinned inside, and at intervals re-tinned. This, at first sight, would seem a sufficient safeguard against the introduction of copper into aerated water manufactured in such cylinders. However, in a paper recently read before the Philosophical Society, Mr. James R. Napier, F.R.S., had very clearly shown that even Loch Katrine water acted somewhat rapidly on the tinned interiors of ordinary cooking utensils—the coating of tin being gradually dissolved away. There was a machine in use in Glasgow for the manufacture of aerated

waters, in which he considered the risk of contamination from lead was quite obviated, whilst that from copper was reduced to a minimum. Of this machine Dr. Milne proceeded to give a description.

Mr. R. R. TATLOCK remarked that there was much more evidence to show that a smaller proportion of lead was more injurious than a small proportion of copper. Lead was certainly a cumulative poison.

The CHAIRMAN said he would be surprised at any medical man in the city who disputed the statement that lead, in any quantity whatever, was of a dangerous nature.

Mr. MAYER was of opinion that those medical gentlemen were most unreliable advisers who entertained such a heterodox view as had been indicated in regard to the undoubtedly poisonous character of lead; and he referred to the numerous cases of lead palsy that occurred amongst painters, lead smelters, and workers in sheet lead and lead-pipe mills. Even amongst medical men there were cases of lead poisoning, owing to lead-contaminated water being used for drinking purposes.

PROCEEDINGS
OF THE
SOCIETY OF PUBLIC ANALYSTS.

Ordinary Meeting, February 5th, 1875.

Dr. REDWOOD in the Chair.

THE second paper read was the following, by Professor REDWOOD, President of the Society:—

NOTE ON THE ANALYSIS OF MILK.

We are indebted to Mr. Wanklyn for the publication of a method of effecting the analysis of milk with a view to the detection of its adulteration with water, which is, I believe, adopted by most public analysts. Mr. Wanklyn has fully described his process, and the apparatus he uses in its performance in his little book on "Milk Analysis." To the public analyst this process recommends itself by its simplicity, and the facility with which the required results are obtained. I believe there is no better criterion by which to judge of the genuineness of cow's milk as supplied to the public than that which is founded on the proportion of non-fatty residue obtained by the evaporation of the milk at the temperature of boiling water. If in addition to this determination, which is the basis of Mr. Wanklyn's method of testing milk, we ascertain the specific gravity of the milk, the quantity of ash it yields, and the nature of the ash, we have all that is required for indicating the presence, and approximatively the proportion, of the common and almost the only adulterant, water. I have always adopted this method of testing milk, and have taken 9.3 parts by weight of non-fatty solids in 100 parts by measure as the assumed smallest proportion of those constituents in genuine cow's milk. This corresponds to 9 per cent by weight. Having occasion to make a large number of milk analyses, not only in my capacity of public analyst, but unofficially for several extensive milk dealers who are also cow-keepers, I am enabled to express a decided opinion, founded upon the examination of samples obtained directly from the cow, under many different circumstances as to breed, age, mode of feeding, and length of time since calving, that the standard or limit adopted by this Society is a safe and fair one. Although many of the samples I have had to examine unofficially have represented in each case the milk of a single cow, obtained under special circumstances, and intended to test the correctness of the standard adopted, I have never met with an instance in which the proportion of non-fatty solids fell below the standard I have referred to in milk obtained from a healthy cow fairly fed, and fit for the supply of so important an article of food as milk. But while 9 per cent by weight may be

taken as a fair representation of the limit below which the non-fatty solids do not fall under the circumstances stated, the proportion is generally higher than this, and is often more than 10 per cent; and as the milk supplied to the public is in most cases the product of several cows, it is reasonable to expect that the limit should be generally exceeded. If it should be found that the milk supplied by a dealer was constantly close upon the limit, it would be fair to infer that some amount of dilution was resorted to, and in cases of this kind I have sometimes recommended prosecutions where the analysis only indicated a small percentage of adulteration according to the standard taken. This statement of my experience merely tends to confirm the results obtained by other analysts, and especially those of Mr. Wanklyn. Doubts have been expressed by some chemists as to the accuracy of the conclusions thus arrived at, and it is therefore desirable, and strictly in accordance with the objects of our Association, that we should encourage our members to supply any reliable analytical results bearing upon the subject. One of the objects I have in making this communication is to set an example in that direction. I have referred to Mr. Wanklyn's process for testing milk, and to the data on which an estimate of the quality of milk is founded. but while I adopt the essential features of his process, I do not obtain the results in exactly the same way as he does. The apparatus I use is different from his, and in some respects I manipulate in a different manner. I always make three experimental determinations, namely, of specific gravity, total solids, and fat, the two latter, by difference, giving the non-fatty solids. The specific gravity is taken with a carefully marked bottle at a temperature of 60° F. The evaporation of the milk is effected in a small porcelain dish heated over a water-bath, and the fat is dissolved out from the dry residue in the dish by means of ether. In ordinary cases these determinations are sufficient, but in doubtful cases, or where there is evidence of adulteration, the ash and the chlorine contained in the part of the ash soluble in water are also determined. These are the results usually obtained, and I refer to them only for the purpose of describing the apparatus I use, and explaining the method of manipulation adopted. I have sometimes as many as ten or fifteen samples of milk to test in a day, and the apparatus I use is so arranged as to admit of this or a larger number being operated upon at the same time without confusion or mistake. The water-bath I use for this purpose consists of an enamelled cast-iron bowl the diameter of which is 9 inches and its depth 4 inches, with a copper cover turned over at the rim, but not otherwise fastened to the bowl. This cover has a brass tube passing through the centre of it to within an inch of the bottom of the bowl, and terminating about 2 inches above the cover. The object of this tube is to indicate, by the escape of steam from the top of it, when the water in the bath has nearly all evaporated. Round the central tube there are five circular holes in the cover, 2 inches in diameter, to receive as many little porcelain dishes. The water-bath is supported on a cylinder of sheet iron, 7 inches in diameter and 9 inches high, with holes round the upper and lower edges of it for admission and escape of air and products of combustion, which forms, with a ring gas-burner, a convenient furnace, the heat of which can be adjusted as required. The dishes are of the best German porcelain, round bottom by preference, well and completely glazed inside and out, 2½ inches in diameter, and 1 inch deep, with a small lip for pouring. These dishes have a capacity of about 1½ fluid ounces, and conveniently receive 200 grain measures for evaporation; each dish is carefully weighed, and the weight distinctly marked with a writing diamond near the outer rim. Each dish when in use is provided with a small glass rod, the ends of which are rounded off in the blowpipe flame. After taking the sp. gr. of the milk and entering it under the number or distinguishing mark of the sample, 200 grain measures of it are transferred from a marked pipette to

one of the dishes, the weight of which is added to the two previous entries, and as the subsequent results, up to the ash determinations, are estimated from residues left in, and weighed without removal from, the dish, liability to error from confusion of samples is avoided. During the evaporation the dishes are all easily accessible and may be conveniently placed to admit of the necessary manipulations. The milk is not allowed to dry up to a hard compact residue adhering to the dish. By means of the rod the skin that first forms over the surface, and would retard evaporation, is broken; and towards the end of the evaporation, when the residue is in a pasty state, this is broken up, granulated, and kept free from adhesion to the dish. In effecting this object, the advantage of using hemispherical porcelain dishes will be experienced, and these dishes are much more constant in weight than those made of platinum. When brought into a finely-granulated condition, the residue can be thoroughly dried without difficulty; and its complete exhaustion with ether is easily effected in the dish, the ethereal solution being decanted off into a little beaker in which the absence of any solid particles can be observed. About three or four washings with ether are sufficient, and the use of a filter quite unnecessary. After exhaustion, the residue in the dish is again dried and weighed, the loss representing the fat. If it should be thought desirable to get the ash, the last residue, transferred to a platinum capsule may be used for the purpose.

Professor REDWOOD, after reading the paper, exhibited and described the water-bath which he was in the habit of employing in his analyses.

Mr. WANKLYN, in inviting a discussion on the paper, said—I am sure we must all feel very much indebted to Dr. Redwood for telling us exactly how he operates. It will be understood that every chemist must operate a little differently from every other chemist. The kind of apparatus that will suit any particular chemist will depend upon his habits, to a certain extent.

Mr. RIMINGTON—Without attempting to remark upon Dr. Redwood's process at all, I would merely state what my own practice is. I use hemispherical evaporating dishes made of glass, and I do so because glass dishes have a better lip, and the milk is more cleanly and easily poured out. We always make two separate residues—one is in a platinum dish, for the purpose of getting the ash; the other, in the glass dish, we evaporate, and take out the fat. We have no filtering, like Dr. Redwood, and we run no risk of washing any minute particles away, because the residue is perfectly dry, and from the glass dish it may be seen whether the solution is perfectly clear or not. The dish being deeper than those which have been shown by Dr. Redwood, and, having a better lip, there is less risk of loss. One of the dishes I should say would hold 3 ounces. Nothing is extracted from them, and I perceive that there is an advantage. The lip of these porcelain dishes is a little too small and too short, and it is not clear of the side.

Dr. TRIPE—I think that one of the most important matters to decide would be the quantity of milk which you would take, whether it should be 100 grains or 200 grains, because there is a very considerably greater difficulty in treating 200 grains than 100, or 500 grains than 200. And I think it would be far better to settle among ourselves whether we should take 500 grains or 100. For myself, I prefer 100 grains. There is a point, also, which has just been raised which quite corresponds with my own experience, and that is, the great difficulty of extracting the whole of the fat from milk when thoroughly dry. It is much easier to get it out before it is what I call thoroughly dry, that is, when milk ceases to lose weight. I am never satisfied with the extraction until I find that there is no fatty matter remaining upon pouring any ether upon the filtering-paper. It is so very much easier to get the mass out of porcelain after evaporation than it is out of the platinum. I think it is rather questionable how far, in making a minute analysis, 200 grains may be taken by measurement rather

than by weight. The specific gravity of milk varies considerably, and of course the quantity of solids varies to a considerable extent. I always weigh the milk. There is another matter which I find very handy: after scratching the weight with a diamond point on the evaporating dish, I write it over with ink, and hold it in the flame of the Bunsen and burn it. The ink is thus burnt in, and no amount of washing by soda will ever wash the mark off.

Dr. REDWOOD—I think that a point to be raised among the members is, whether the milk should be weighed or measured. I have adopted measuring as being more convenient than weighing.

Mr. E. T. W. JONES—I adopt the process of weighing; I think it is capable of more accuracy. I use platinum where I want the ash, but glass dishes where I want no incineration, and I use a stirrer. I pour in about 5 grms. of milk approximately, or what I think to be 5 grms. I then weigh it accurately. Then, as to the estimation of the fat, I use a large glass dish measuring about 4½ inches across, add about 10 grms. of milk, and weigh accurately. I do not evaporate quite to dryness; but before it gets to dryness I watch it and stir vigorously, so as to get it all into about the same state of dryness. I then quickly add a little ether, which, after subsidence, I can pour off perfectly clear. By using a large stirrer you are able to bring the whole of the non-fatty matter into a state of perfectly fine division, and one in which you can satisfy yourself that it is perfectly free from any fatty matter whatever. The process is clean and simple, and it appears to me that it avoids the danger that is likely to occur from loss in filtering. It has always been successful in my hands. As to taking the weight of the dishes as constant, my experience with both porcelain and glass is certainly against ever taking the weight of the dish as constant from operation to operation. I mark the weight on the dish, going only to the second decimal place, and thus get the approximate weight.

Mr. ESTCOURT—The statement of results seems to be an important point. According to one certificate, milk has been found adulterated with 100 per cent of water, which certificate the *Sanitary Record* cavilled at. One quart of milk which has had one quart of water added might be indicated as having 50 per cent or 100 per cent of water added, according to the two methods of calculation. It is necessary for us to decide how we shall state the quantity in presenting a certificate to persons who are not accustomed to make these calculations, and, therefore, who might justifiably imagine that one of the analysts must be wrong if two analysts state the same result in different ways.

Dr. DUPRÉ—I invariably give my certificate stating that so much water has been added, and I usually add "Or so many pints of milk have been made into so many pints of milk and water." I do so because it is the only way which gives you a fair idea of the amount of adulteration really practised. According to what seems to be the more general plan, you say that there is 25 per cent or 50 per cent of water. Well, that apparently seems to say that in one case there is added about twice as much water as in the other,—whereas, if you state it correctly, in one case the added water is 33½ per cent of the original milk, and in the other 100 per cent. One man has added exactly three times as much as the other. As regards the rest I may fully corroborate the president. These dishes if they are not ignited will remain long constant. You need not, perhaps, for months trouble yourselves about any correction of the weight. As to the extraction by ether, I always let it stand over night. I can generally give them time; and then I invariably also extract them with water, and weigh the residue. I do it for the purpose of being quite satisfied myself that no other adulteration has been practised, because it might be possible that something has been added to it which you afterwards extract with water. I invariably ignite my milk in a porcelain dish. I have done it hundreds of times, and I never found any difficulty about it. The dish does vary

a little, but the variation is so small that in a milk analysis it may be entirely neglected.

Mr. STEVENSON—I should like to say that the question of extraction of fat, I believe, is a matter of time. I always have found it quite unnecessary to perform the operation by stirring the milk towards the end of the process, if you only give the solid residue a sufficient soaking after it is evaporated; and indeed I prefer not to stir it and make it granular, because, when you do not stir, you obtain it in thin films, which are readily permeated by the solvents. On comparing the results obtained by long soaking and other methods, by extracting in the ordinary way, by granulating it in the mode in which our president has described, and then extracting the ether, I find that by long soakage I obtained more fat than by any other means. I find that in long soakage the petroleum spirit, or benzoline, which leaves no residue on evaporation, is an excellent solvent for this purpose: it is cheaper, more convenient, and not so volatile as ether, and admits of the warming of the residue without the fluid evaporating, and leaving the fat again in the solid form. I prefer this solvent to any other; it seems to permeate the solid residue better than any other solvent. My own practice has been, when the residue has been obtained by evaporation, to warm it twice, for about half-an-hour each time, with benzoline; then cover it well with the benzoline, and let it stand all night. That is decanted off again, and then it is soaked about five minutes in ether, and the whole dish is washed in ether, placing it over a glass vessel, so that you can see if any of the particles are dislodged. It is very rarely that such an accident occurs; if it does occur it is easily remedied, and you do not lose anything. Then dry that off in the water-bath. With regard to the statement of the results, and the question of weighing or measuring the milk, I think it is most important; and the discussion which has taken place this evening shows a confusion of ideas arising as to working by weight. We have heard Dr. Redwood speaking of 9.3 per cent of solids by weight, and we often hear that spoken of as Prof. Wanklyn's standard. Now, I believe generally that Prof. Redwood and others have taken it that his standard table was 9.3 grains of solids not fat in 100 grains of milk, volume by volume, whereas, if you look to Prof. Wanklyn's work, the 9.3 he adopts really means 9.3 by weight of solids not fat in 100 grains by weight of milk. It is so if you look in his book, so that we have had constantly in our discussions people speaking of 9.3 of solids not fat, by weight, and meaning two different things. It is exceedingly difficult to convince even an experienced lawyer's mind as to the exact meaning when you speak of grains by weight. This question has been put to me, and it is exceedingly difficult to answer:—"One hundred grains by volume of milk contains 10 per cent of solids?"—"Yes." "Does 100 grains by volume of milk weigh 100 grains by volume of water?" You are obliged to say "No," and then it is almost a hopeless case to explain that 100 grains by volume of milk and 100 grains by volume of water are of a different weight. One hundred grains by volume is only a thing which exists in our laboratories: it is not known to the public, and therefore ought not to be adopted. I invariably weigh the milk, and express the results of the solids, and the solids not fat, in grains by weight, and I think that is the only satisfactory way to state results. With regard to the statement of the percentage of the composition on our certificates, I think that the method adopted by Dr. Dupré—and his arguments have almost convinced me to-night—is a correct one: it does not appear, however, to be the one generally adopted. If you state that the milk consists of 20 per cent of water in your certificate, it is liable to the two interpretations which have been mentioned this evening. I have, for some time, altogether avoided the use of the expression "per cent;" but I state that the liquid is a mixture of milk and water, consisting of 80 parts of milk and 20 parts of added water; or, that the milk is mixed with so many parts of water. I thought

that there could be no misinterpretation of my meaning: however, to my surprise, the other day a magistrate in London—one of our most experienced stipendiaries—adjourned a case because he did not understand my certificate, and he requested that in future it should be stated differently. I thought it was perfectly clear. The reason which would induce me, perhaps, in future to adopt Dr. Dupré's plan is that, when you state the amount of water added to 100 per cent of milk, the quantity of added water then is a correct guide to the proportion of water which has been added; whereas, if you state that the percentage of water in 100 parts of the mixture is so-and-so, the percentage of water forms no guide—at least, without calculation—to the amount of water which has been added.

Mr. ALLEN—With respect to what has been said as to the labelling of the dish, I may say that I have been in the habit of using flat-bottomed porcelain dishes, which are not glazed at the bottom outside, and I write the weight on them with a lead-pencil. It may also interest some chemists here present, although it is a little beside the subject, to say that I have given instructions to a glass-manufacturer in London to have some beakers made for me with a circle of ground glass etched on the side, by means of the sand-blast, so as to enable me to write the weight, or any label I like, on the side of the beaker, in ink or pencil, instead of sticking a paper label on. With respect to the petroleum spirit, I agree with Dr. Stevenson that it is a very convenient solvent. As to whether we should take the weight or volume of the original milk, I have been in the habit of taking the volume. At the same time I shall be inclined to take the weight in future, because the limit which we adopted recently specifies 9 per cent by weight. I therefore prefer to do it by weight. I have always been in the habit of taking the original gravity, so that it would give me the means of calculating exactly from the 10 centimetres which I employ to the corresponding weight. As to the method of stating the proportion of water, though I quite agree with much that Dr. Dupré has said, I think that it is met by saying that the milk is adulterated by so much per cent of water, or so as to make 8 gallons of original milk into 10 gallons of milk and water, assuming 20 per cent of water. It certainly would have an advantage if we were to say that every 100 volumes of the original milk has been adulterated with 25 per cent of water, so as to make 8 gallons into 10: that is, practically, 80 made into 100. I quite agree with those who say that it is necessary to humour the magistrates, because they are apt to misunderstand unless it is put clearly before them; and we suffer very much from misinterpretation of all sorts, without leaving anything else open to be misunderstood. With respect to taking the gravity of the original milk, I always intend to do so, for the purpose of disproving the remarkable statement that was made by a gentleman reading a paper in public, in the course of last year, that a milk purposely adulterated with water would always have an original gravity of less than 1.025.

Dr. TRIPE—I recently obtained a specimen of very rich milk; I skimmed it, added water to it, and got a higher specific gravity when I had added 25 per cent of water. The specific gravity of milk which had three-fourths of the cream taken away was 1.031. I just merely mention that to show the utter futility of depending in any way whatever upon specific gravity. As to this question of the form of the certificate, I always have put it "Adulterated with so much of added water." If 20 per cent, I say "One-fifth added water," and not "20 per cent." If it is 25 per cent, I say "One-fourth of added water." They understand that perfectly well. That there may be no mistake as to the percentage, I put also, in brackets, "25 per cent," or whatever it may be, besides putting in plain English "Adulterated with one-fourth."

Mr. RIMMINGTON—As we are telling our experiences, it is just as well that we do tell them clearly and honestly. It appears that it is common in London to state the result

of the analysis on the certificate. The Act does not require it. The Act says that the analyst shall say whether it is adulterated or is not, and, if it is adulterated, whether it is injurious to health. That is all that the Act requires, and I am advised to say no more than what is just necessary, leaving the rest to come out in evidence. This is a hint which, if it is adopted, you will find will save a great amount of trouble. If you begin to state the result of the analysis upon the certificate, you get a number of questions put to you which it is not always very easy to answer.

Mr. WANKLYN (the Chairman)—Before calling upon Dr. Redwood to reply, I should like to make one or two remarks. As is well known, I employ platinum vessels. These vessels are not so constant as glass or as porcelain, but they are sufficiently constant for the purpose. The reason why I think that platinum is preferable to porcelain or glass is that it is cold almost the moment that it is taken out of the bath, and you save a great deal of time by working in platinum. In the year 1871 I had occasion to make a great many hundred milk analyses, and I had more than a thousand made for me. As you may imagine, it was all-important to me to ascertain what would save time, and the little modifications that I have adopted have many of them for their object to save time without sacrificing accuracy. With regard to the mode of stating results, I was aware of the possible confusion when I wrote my little book, and I devoted a chapter to explaining the two methods of statement. There is percentage, which, I think, everybody understands, which is that 100 parts by weight yield so and so; and there is the other form. Now, to avoid any confusion, I keep to the French weights. There is the percentage form, and there is the volume form. The volume form is—"100 cubic centimetres contains so many grammes." That is perfectly unambiguous, and if you wish to reduce that to percentage you calculate on 103. One hundred cubic centimetres of average milk weighs 103 grammes, or so nearly so that the difference makes no matter. With regard to the giving of certificates, the form I use is a duplicate statement. I state the composition of the sample:—"This sample of milk contains so much milk and so much water, or it was made by adding so much water to so much milk," so that the magistrate can choose the form in which he likes to regard the certificate.

Dr. REDWOOD—I have very few words to say in reply to the discussion. I am very glad to find that the few very unimportant points that I brought before the meeting have led to a much more important discussion. My reply will have reference to very few points. One is with regard to the little porcelain dishes which I use. I have been asked by one or two as to whether I am quite correct in indicating the simple amount of alteration that takes place in their weight after long and habitual use. I beg to observe that, in order to insure their almost complete invariability in weight, it is necessary to carefully select the dishes, and to see that they are glazed over the upper surface as completely as possible. It will be found that some of them have a rough edge, and those are the dishes that will alter most in weight. I must say that I should expect that dishes such as Mr. Allen has referred to, not glazed at the bottom, would be subject to that defect, and to another defect also; because I find that, where the glaze does not completely cover the porcelain, not only does abrasion take place there, but absorption of moisture also; and with the dishes I use, in a water-bath, it is very difficult to keep them in a perfectly uniform condition in that respect. But when a good selection of dishes has been made, and they are not continued in use after they become roughened upon the upper surface, I certainly do find that they vary very little indeed in weight. I have stated that a variation to the extent of a hundredth of a grain in the weight of the dish—which ranges from about 350 to 450 grains—is as great a variation as I generally find to occur after a lapse of several months. One other point relates to the solvent used for taking out the fat.

I use ether, not because I consider ether a better solvent than benzoline would be, and certainly not a cheaper solvent; but methylated ether answers the purpose perfectly well. The cost is not a material matter as regards the quantity used, and I prefer to use ether mainly because—where the question arises as to how the fat has been taken out—ether is a more definite body than if we have to speak of benzoline or benzole, or any body of that description. But the benzolines, especially, are extremely complicated, and some little doubt or difficulty may arise from that cause.

Some Recent Adulteration Cases.

From a number we select a few, each of which we think has some point of interest to the analyst.

At Greenwich Police Court two grocers were convicted, on the certificates of Mr. Wigner, of selling caper tea, containing siliceous matter in the respective proportions of 7 and 8 per cent. The magistrate stated that the defendants were "strictly liable for selling the article adulterated," but from "his experience in China" he had no doubt that the sand or quartz arose from dust accidentally blown on to the tea when in the process of drying. He therefore imposed no fine, but ordered the defendants to pay 2s., cost of summons. This decision appears to have given great satisfaction to the grocers, and a paper specially advocating their interests devotes a leading article to the case, under the heading "Common Sense from Greenwich."

At the Thames Police Court a cowkeeper was summoned for selling adulterated milk, Professor Anderson certifying that 9 per cent of water had been added. Dr. Tidy, however, certified that he had examined a portion of the same sample, and he considered it pure. The magistrate eventually dismissed the case, and granted the defendant £2 costs. It would be as well, in cases such as these, if each analyst would give the figures upon which he arrives at his conclusions, as in the absence of these data it is impossible to decide between the conflicting testimony.

As illustrating the different views held by different magistrates as to the culpability of adulteration, we may mention two very recent milk cases, in both of which convictions were obtained and penalties inflicted, but in strangely varying proportion.

At Woolwich a dairyman was convicted of adding 16 per cent of water to his milk. The magistrate admitted that he was compelled to convict him, but affirmed his belief that the defendant was "a respectable man who would not defraud the public," and to express his opinion he inflicted a fine of *half-a-crown*, and two shillings costs.

At the Salford Police Court, another dairyman was convicted of adding 29 per cent of water to his milk, and was promptly fined *twenty pounds* and costs, without even the alleviating accompaniment of an expression of magisterial regret.

It would almost appear, from these two cases, as if geography must have something to do in determining the relative criminality of persons selling adulterated articles, as what is clearly quite a venial offence in Kent becomes rather a serious matter in Lancashire.

"The Sale of Food and Drugs Act, 1875."

The new Adulteration Act, bearing the above title, was introduced into the House of Commons last Friday by Mr. Sclater Booth, and the second reading was fixed for this day (Friday). The clauses of the Act are not yet made public, but it is understood that its general purport is to repeal all the previous Acts, and replace them by one Act applying to England only, leaving Scotland and Ireland to be separately legislated for. A special provision is expected to be made for examination of tea in bond. Provision will also be made for exemption of labelled mixtures, and a penalty will be imposed on dealers refusing to supply the inspectors.

Next week we hope to give a report of the proceedings in the House.

NOTICES OF BOOKS.

Proceedings of the American Pharmaceutical Association at the 21st Annual Meeting. Philadelphia: Sherman and Co.

THIS bulky volume, extending to upwards of 700 pages is a proof of the energy and activity of the Association by which it is issued.

As is necessarily the case with publications issued only annually, the majority of the chemical facts mentioned are no longer novel by the time the work can reach our hands. Nevertheless it is a great convenience for pharmacutists to have all discoveries bearing upon their profession collected together in a form suitable for reference. We are struck with directions for preparing oxygen from chlorate of potassium "from which woody particles have been carefully removed." Surely it is gross carelessness on the part of manufacturers to send out chlorate of potash contaminated in this manner. The report on the adulteration of drugs and chemicals brings to light some interesting facts. Gum benzoin was found adulterated with hemlock-bark. Worthless cinchona barks are sometimes sprinkled with an alcoholic or acetic solution of quinoidin. Cacao butter is made up with wax and coconut oil. The only pure mustard in commerce is stated to be Früauf's, from Russia. The finest mustard in the world is produced on the lower Volga. Castor oil has been found containing 5 per cent only of the genuine matter, the residue being whale-oil. Linseed oil and refined rape-oil are sophisticated with rosin oil. An American company have been circulating advertisements of a certain "neutral oil" for the express purpose of "manipulating" lard oil, raw and boiled linseed, refined cotton-seed oil, and castor oils. "It will enable you" says the circular "to make large profits on articles that heretofore hardly paid to handle." "Handling" and "manipulating" are polite words which adulterators on both sides the Atlantic use in speaking of their thievish operations. An article sold as sulphate of ammonium proved to be the sulpho-cyanide, and was, of course, very destructive to vegetation. As much as 25 per cent of sawdust has been found in iodine. The editors hope that this may be rather an accident than a fraud. Iodide of potassium may contain 9 per cent of bromide. Bromides have been found with 35 per cent of impurities, carbonates, sulphates, chlorides, and iodides. Chocolate has been found to contain powdered cantharides, an admixture employed doubtless for criminal purposes. The use of poisonous colours in ornamenting confectionery, and in getting up papers in which articles of food are developed is stated to be on the increase. We beg to call the attention of our public analysts to this mal-practice, and we hope that it will not escape the notice of Government.

Dried willow leaves are now extensively used for the adulteration of tea. According to Consul Medhurst more than 53,000 lbs. of these leaves were in preparation in Shanghai at one time.

These few extracts, which might be greatly extended, will show the highly valuable character of the volume.

Assaying by the Spectroscope Experiments made in the U.S. Mint. Philadelphia.

THE interesting memorandum of Mr. W. Chandler Roberts, chemist to the Mint, pointing out that he was engaged conjointly with Mr. J. Norman Lockyer in examining the application of the spectroscope to the quantitative analysis of alloys of the precious metals has excited much attention. The authorities of the United States Mint instructed Mr. A. E. Outerbridge, an assistant in their Assay Department, who had given special attention to spectroscopy, to submit this new mode of analysis to a careful examination, and to ascertain its possibilities. The pamphlet before us contains the results obtained by the experimentalist as described in two letters addressed by him to his

official superior, Mr. W. E. Du Bois, Assayer of the Mint, and communicated by the latter with a few introductory remarks to the American Philosophical Society (May 15, 1874).

These results, we regret to say, are not encouraging. One of the greatest obstacles encountered is "the natural and necessary imperfection of metallurgy, the want of complete atomic homogeneity in the mixing of the metals" which, as the reporter fears "will for ever prevent the spectroscope from taking the place of the present methods of assay." The quantity of metal vapourised and giving the spectrum seems too infinitesimal to give safe results for a large melt, as it must be affected by the least want of homogeneity in the metal. How difficult such perfect homogeneity is to attain may be learned from the valuable memorandum of Mr. Chandler Roberts on the preparation of new standard plates for the British Mint. The amount of gold consumed in furnishing a spectrum, Mr. Outerbridge estimates as follows:—An electrode loses $\frac{1}{10000}$ of a grain after passing 3000 sparks, or for 1000 sparks $\frac{1}{1000}$ of a grain, or for each spark $\frac{1}{1000000}$ of a grain. "The exceedingly small quantity of metal thus assayed," he continues "renders this process, to my mind, inapplicable to the operations in the Mint; for it is necessary to determine gold assays to the $\frac{1}{10000}$ th part of the normal assay weight, and it is hardly conceivable that a discrimination of the $\frac{1}{10000}$ part of the spark assay weight or the $\frac{1}{1000000}$ of a grain is practically possible. Even if it were, it would not be proper to assume that a test on such an atomic scale would correctly represent the value of a large deposit, or even of gold ingots. It would certainly, not be in the case of silver, which segregates."

A curious and unexplained anomaly was noticed relating to the sensitiveness of the spectroscope to metals present in small quantities in the form of alloys. It has been shown by Mr. Capel that $\frac{1}{1000}$ of a milligramme of gold will show a spectrum, if the spark be passed through a weak solution of the pure metal. But when operating on a slip of alloy formed of—

Silver	..	..	..	..	708
Copper	..	..	..	..	254
Gold	..	..	..	..	38
					1000

the spectra of copper and silver alone were visible. In an alloy of gold and copper containing from 200 to 250 parts in the thousand of the precious metal, the gold spectrum is barely visible. On the other hand, in an alloy of gold and copper containing 1 per cent of the latter, the copper spectrum was distinctly shown. In copper alloyed with 20 per cent of nickel the spectrum of the latter is not visible. Hence we arrive at the interesting fact that where two or more metals are present, "the spark will to some extent elect for its vehicle the one which is most rapidly volatilised."

Commenting on these facts Mr. Outerbridge remarks somewhat pointedly, that:—"If the spectroscope fails to reveal the presence of anything less than 200 parts of gold (20 per cent) in a base alloy, even a theorist must admit that one could scarcely expect to be able to discriminate with certainty, a variation of $\frac{1}{10000}$ in a fine alloy." He therefore concludes, "not without regret, that assaying by means of spectrum analysis is impracticable for the purpose of Mint operations."

As an interesting fact, incidentally observed, it may be mentioned that "the loss in weight of the volatile metals very slightly exceeds, and in some cases does not equal, the loss of the less volatile metals."

Although the researches of Mr. Outerbridge have thus, for the present, failed as regards their more immediate object, they must not the less be pronounced a valuable contribution to spectroscopic analysis. We shall await with increased interest the results of the investigations with which Mr. Chandler Roberts and Mr. J. Norman Lockyer are still engaged.

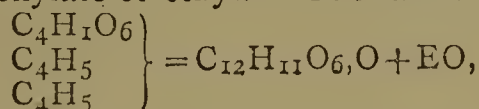
CORRESPONDENCE.

THE CHEMICAL SOCIETY.

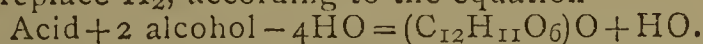
To the Editor of the Chemical News.

SIR,—The confusion at the Chemical Society, in regard to the relations of glyoxylic acid, seems curious if not characteristic. When doctors disagree, it is hardly fair for an amateur to presume on a decision; nevertheless, for a large class of student readers a few hints may be offered.

Mr. W. H. Perkin, as usual, is a clear and safe guide, and few things are better established than the constitution of glyoxylic acid. Besides giving the amide $(C_4H_3O_6)H_2N$ and a good saltic list, Mr. Perkin said, "When that acid is heated with alcohol to 120° , it yields the compound "Diethyl-glyoxylate of ethyl." The radical becomes—



or E_2 replace H_2 , according to the equation—



M. Schreiber showed the same thing in 1870, and further obtained the amide $(C_{12}H_{11}O_6)H_2N$ in solid crystals fusing at 76.5° . Of all this Dr. Debus seems quite oblivious, and evidently confuses the matter with glyoxylic acid $C_2H_2O_3$, which in old notation would be $(C_4H_1O_4)O + HO$.

As acetic acid $-O_2 =$ aldehyde;

So glyoxalic acid $-O_2 =$ glyoxal or glyoxalic aldehyde.

M. Schiff's recent research on glyoxal is somewhat confused in a similar way, and his six-fold condensation is called "Hydro-hexa-glyoxal," of which he obtained aceto- and benzo-substitutional varieties. It is, however, manifest that in his oxy-condensing process the aldehyde is made to assimilate $2HO$ to the production of another acid, and it is almost beyond question that he might have said—



That this body would give an amide $(C_{24}H_{13}O_{24})H_2N$ is a foregone certainty.

The wonderful amount of labour, skill, and penetration evinced by Strecker, Baeyer, and others in ureide researches is much to be admired; but this same confusion is there woefully paramount.

Just as oxalic acid + urea $-aq. =$ oxalyl urea,

So mesoxalic acid + urea $-aq. =$ mesoxyl urea,

and these radicals, or H replacements, under very slight conditions, change, in one case giving glyoxalyl ureides $(C_4H_1O_4)$, and in the other tartronyl ureides $(C_6H_1O_6)$; but the names and types are exceedingly confused, and the difficulty is enhanced by the fact that some of the acids are mono-, and others (so-called) dibasic.

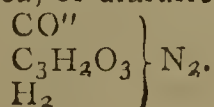
The following ureas are some of the simplest representations of these associated radicals:—

- | | |
|---------------------------|--------------------------|
| (1). Oxalyl urea | $(CO_2)(C_2O_2)^2H_2N_2$ |
| (2). Glyoxalyl urea | $CO_2C_4H_1O_4H_3N_2$ |
| (3). " " | $CO_2C_4H_1O_2H_3N_2$ |
| (4). Mesoxyl urea | $CO_2(C_3O_3)^2H_2N_2$ |
| (5). Tartronyl urea | $CO_2(C_6H_1O_6)H_3N_2$ |
| (6). Malonyl urea | $CO_2C_6H_1O_4H_3N_2$ |
| (7). " " | $CO_2C_6H_1O_2H_3N_2$ |
| (8). Glycolyl urea | $CO_2C_4H_3O_4H_3N_2$ |
| (9). Glyoxyl urea | $CO_2C_4H_3O_6H_3N_2$ |

No. 3 is called glycolyl urea, or hydantoin $\left\{ \begin{array}{l} CO'' \\ C_2H_2O \\ H_2 \end{array} \right\} N_2$.

No. 2 is called allanturic acid $\left\{ \begin{array}{l} CO'' \\ C_2H_1O_2 \\ H_3 \end{array} \right\} N_2$.

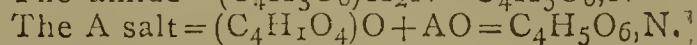
No. 5. Tartronyl urea, or dialuric acid, is notated—



It remains, therefore, that the acids of Nos. 3 and 7 should be identified and named; but the working character of the Chemical Society does not seem a very hopeful field for the attainment.—I am, &c.,

SAMUEL E. PHILLIPS.

PS.—It only just occurs to me that another element of confusion subsisted in this way. By a curious slip of the pen (I trust) Mr. Perkin calls his "Diethyl-glyoxylate" a glyoxalate; and with a perverse inversivity Dr. Debus calls the ammonium salt of glyoxalic acid a glyoxylate! It also further happens that the glyoxylic amide and the ammonium glyoxalate are isomeric.



PRODUCTION OF ANILINE COLOURS WITHOUT THE USE OF ARSENIC ACID.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS (vol. xxxi., page 56) appeared an article, "On the Production of Aniline Colours without the Use of Arsenic Acid," which mentions our firm, and says that although we succeeded in working this process on a large scale, we were manufacturing our colours only in part by this method.

In reply to this assertion, we beg to state that since the end of 1872 we have not been using any arsenic acid in our works at all, and that our magenta or fuchsine, as well as all the other colours manufactured by our firm, are warranted to be produced without the employment of arsenic acid, and to be entirely free from this poisonous reagent.—We are, &c.,

MEISTER, LUCIUS, AND BRÜNING.

Hoechst-on-Maine,
Feb. 11, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 3, January 18, 1875.

Saline Matters which the Sugar Beet-Root draws from the Soil and from Manures.—E. Peligot.—The author calls attention to a point generally overlooked in comparative agricultural experiments—the identity of the seed. In his opinion, the discrepancies and anomalies noted in such experiments are due less frequently to the mode of cultivation than to the strain of the seed. Since 1861 he has cultivated a small number of beets derived from about a score of seeds given him by M. L. Vilmorin, the result of experiments made with the aim of developing, by artificial selection, the proportion of sugar in the root. Their yield was from 14 to 17 per cent. The seeds sown in the open ground were re-planted in pots, care being taken to select roots of the same form and appearance. Pots holding about 30 litres were filled with ordinary garden earth of known composition. From July 1st to October 15th, 1871, six beets, which had been potted several weeks, received—Nos. 1 and 2, suitable waterings with Seine water, containing 1 gm. of sea-salt per litre; Nos. 3 and 4, with the same quantity of water, containing 1 gm. chloride of potassium; and Nos. 5 and 6 had the same volume of water without addition. Each of the former lots had received 30 grms. of salts. After some weeks, each couple presented a characteristic appearance which distinguished it from its neighbours. The presence of a saline matter, employed in a predominating quantity, gives the plant, therefore, a specific physiognomy. They yielded—

	Weight of Root.	Ash. Per cent.	Chloride of Potassium. Per cent.
No. 1. (Sea-salt)	560.2	0.77	18.6
No. 3. (Chloride of potassium)	571.5	0.97	15.3
No. 5. (Water)	721.8	0.64	8.0

The sugar was about 15 per cent. This result is contrary to the common opinion that beet-roots rich in chlorides are poor in sugar. These two facts do not stand in connection. The chlorides accumulated in the leaves; for while the roots did not contain more than 3 to 6 per cent of mineral matter, the dried leaves having lost their 50 per cent of water, give 25 to 32 per cent. The saline matter of this ash contained from 23.7 to 73.5 per cent of chlorides. Even in beets watered with solutions of sodium chloride, the potassium is more abundant than the sodium. The experiments were resumed in 1872 under conditions very similar. The plants were watered from July 21st to October 9th with Seine water containing 1 grm. of chloride per litre in Nos. 3, 4, 5, 6, and 2.5 grms. per litre in Nos. 7, 8, and 9. The following was the composition of the roots:—

	Weight of Root, Grms.	Sp. Gr. of Juice at 15°.	Ash in 100 Parts of Juice.	Chloride Potassium in 100 Parts Ash.	Sugar in 100 Parts of Juice.
No. 1. (Water)	680	1080	0.83	7.1	15.3
No. 3. (25 grms. sea-salt) ..	635	1081	1.07	16.3	15.0
No. 5. (25 grms. potassium chloride)	650	1083	0.89	13.2	14.0
No. 7. (75 grms. sea-salt) ..	682	1087	1.07	27.3	16.4
No. 9. (75 grms. potassium chloride)	645	1090	1.20	26.8	15.8

It is seen that the absorption of chlorides increases with the quantity supplied to the plants; it has, nevertheless, its limits, and is not proportional to the quantity, since the two last roots contain scarcely double the quantity of chlorides of the former, whilst they have received triple the quantity of salts. Both chlorides and sulphates were found in very much larger proportion in the upper part of the root than in the lower. As their presence in the juice causes the formation of molasses, manufacturers ought to operate upon roots well freed from their necks. Water and saline matters were also found more abundant in the central parts of the root than in the exterior, whilst the latter were more charged with salts of lime and magnesia. In 1873 beets were cultivated in a very poor siliceous earth, sparingly penetrable by water, and cracking in time of drought. From July 3rd to September 3rd the roots received—

- Nos. 1 and 2.—24 grms. of sea-salt, at 2 grms. per litre of Seine water.
- Nos. 3 and 4.—The same weight of potassium chloride.
- No. 5.—36 grms. nitrate of potash, 4 grms. per litre of water.
- No. 6.—The same weight of soda nitrate.
- No. 7.—25 grms. ammonia sulphate.
- No. 8.—35 grms. sal-ammoniac.
- No. 9.—Seine water without addition.
- No. 10.—42 grms. acid phosphate of lime (6 grms. per litre of water).
- No. 11.—24 grms. of Jeannel's mixture, *i.e.*, phosphate of lime, sulphates of ammonia and magnesia, nitrate and chloride of potassium.

In August the aspect of the plants was different: the leaves of Nos. 1 and 2 were ill-developed, and began to turn yellow. In Nos. 3 and 4 the leaves were very small and yellow. It seems that the alkaline chlorides, unless accompanied by fertilising matters, do not exert a useful effect on vegetation. In the plants watered with the nitrates, the ammoniacal salts, and phosphate of lime, the leaves were of a deep green, large, and plentiful. The beet watered merely with Seine water was little developed; the leaves were small and yellow. On October 14, No. 10 showed the most luxuriance; and next, those which had

received ammoniacal salts and Jeannel's mixture; then the nitrates. On October 28th, a part of the roots and leaves were weighed. No. 10 was the finest; its root weighed 932 grms. If we represent this weight by 100, we have the following proportions for the weight of the other roots:—Nos. 5, 6, 7, 8, from 34.3 to 36.7; Nos. 1, 3, 9, from 6.3 to 13.4. The ashes of these beets do not present very striking differences of composition. No. 7 contained 9 per cent of alkaline sulphates, or about double the normal quantity. No. 10 gave an ash of the following composition:—

	Roots.	Leaves.
Silica	0.5	1.7
Carbonate of lime	5.3	27.7
Phosphate of iron	1.6	1.5
Phosphate of magnesia (bibasic) ..	8.0	8.5
Phosphate of potash (tribasic) ..	29.8	5.7
Sulphate of potash	5.4	6.4
Chloride of potassium	4.8	6.5
Carbonates of potash and soda ..	44.6	41.8
	100.0	100.0

Thus the use of soluble phosphate of lime diminishes the proportion of calcareous salts absorbed by the plant. The amount of phosphoric acid is approximately alike in all beet-roots, and is not increased by watering with phosphate of lime in solution. This result throws a new light upon the part played by phosphates in vegetable production. Many salts are absorbed by plants unchanged, such as the alkaline nitrates, the use of which in manures causes great annoyance to the sugar manufacturers.

Temperatures Below Soils Covered with Turf, or Denuded.—M. Becquerel and E. Becquerel.—The temperature below the denuded surface, in frosty weather, is much the lower.

Ammonia of the Atmosphere.—M. A. Schlöesing.—The author shows that in the transformations of organised beings a certain quantity of nitrogen leaves the combined state and is set free, so that the total sum of azotised compounds existing in the world would suffer continual diminution if there were no restoratory process. Such a process has been placed alternately in the atmosphere, in plants, and in soils. The action of the last being doubtful, and that of the second no longer admitted, atmospheric electricity seems to be the sole restorative process which is definitely established. The author proposes to examine whether the quantity of combined nitrogen brought down by rain is really sufficient to maintain the equilibrium. The sea serves as an immense reservoir of combined ammonia.

Functions of Fungi.—M. Müntz.—It is well known that fungi, placed in an atmosphere containing oxygen, absorb this gas, and give out carbonic acid in equal volume. Marcet shows that when the oxygen is consumed they develop carbonic acid at the expense of their own substance, but their production of hydrogen is not unanimously accepted. The author's experiments prove that if oxygen is excluded the production of hydrogen is considerable.

Decomposition of Fehling's Liquid; Determination of Glucose in Presence of Sugar.—P. Champion and H. Pellet.—To determine glucose in presence of excess of sugar, the authors add an excess of Possoz's liquid (a modification of Fehling's, in which carbonate of soda is used instead of caustic), and keep it at 75° in the water-bath for three-quarters of an hour. Collect on a filter the suboxide formed and wash it; then place the filter, still damp, in a capsule, and add dilute hydrochloric acid, which converts the suboxide of copper into subchloride. The liquid is collected and raised to a boil, adding by degrees some crystals of chlorate of potash. The liquid becomes coloured, and the copper passes into the state of bichloride of copper of a greenish yellow, when it is titrated with chloride of tin. The ebullition is maintained till all the chlorine products have been expelled. This is ascertained

by fixing to the mouth of the flask containing the solution a tube bent twice, and plunged into water coloured blue with sulphate of indigo. In this manner a few milligrams of glucose may be determined in 100 grms. of sugar.

Bulletin de la Societe Chimique de Paris,
No. 12, December 20, 1874.

Thermic Study of the Phenomena of Solution; Reaction of Water with Nitric Acid.—M. Berthelot. —Not suited for abstraction.

Definite Hydrates Formed by Acids and Alkalies in Solution.—M. Berthelot.—The author submits proofs of the existence of such hydrates in solution, in opposition to the views of Prof. Thomsen.

Synthesis of Purpurin.—M. Felix de Lalande.—M. Rosenstiehl has repeated and confirmed the author's experiments described in *Comptes Rendus*, lxxix., p. 766. He adds a few words on his preliminary researches:—Having caused nitrate of methylen to act upon alizarin in sealed tubes at 100° C. for several hours, he obtained, after evaporation of the liquid, a body having the aspect of alizarin, and dyeing with aluminous mordants an orange-yellow; not very bright. In contact with water, and more rapidly with alkalies, this substance is transformed into a new colouring matter, the properties of which have a certain analogy with purpurin, being, like it, soluble with a gooseberry-red in alkalies, and dyeing a red with alum mordants. Strecker, in 1869, obtained an analogous body by the action of fuming nitric acid upon alizarin. When boiled in water it gave rise to a compound analogous to purpurin, which Strecker named nitroxyalizarin, or nitro-purpurin. The author has prepared this body according to Strecker's process, and finds it identical with the substance obtained by the action of the nitrate of methyl. Purpurin treated with nitric acid gave a body having the same properties as nitroxyalizarin, whence the author concludes that the latter is the nitro compound of purpurin. Hence he inferred that in the action of nitric acid upon alizarin it may be divided into two phases—the transformation of alizarin into purpurin; and, secondly, the nitro-substitution of the latter.

Distribution of Bands in Primary Spectra.—G. Salet. —Already noticed in the CHEMICAL NEWS.

Action of "Glover's Tower" in the Manufacture of Sulphuric Acid.—M. Vorster.—Glover's tower is placed between the furnaces evolving sulphurous acid and the lead chambers. The hot gases proceeding from the kilns pass through a rain of chamber acid and of nitrated acid. The heat concentrates the acids by evaporating water, and the nitric acid present in the nitrated acid is converted partly into nitric oxide, and partly into free nitrogen. At the foot of the tower the acid, concentrated and freed from nitrogen acids, is collected. In such a tower, 9 metres high by 3, 1400 kilos. of water are evaporated in twenty-four hours, whilst 550 to 600 kilos. of sulphuric acid are formed. From 3.5 to 4 per cent of the acid passing through the tower is evaporated. Although the acid is freed from nitrogen compounds to a satisfactory extent by the action of the sulphurous acid, yet from 40 to 70 per cent of these compounds—according to temperature—are reduced to the state of nitrogen gas.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of metallic compositions having phosphorus combined therewith, the same being applicable for bearings and other parts of machinery exposed to friction. Edward Primerose Howard Vaughan, F.C.S., patent agent, Chancery Lane, Middlesex. (A communication from Charles Künzel, Ph.D., Blasewitz, Saxony.) May 8, 1874.—No. 1628. This invention consists in the manufacture of metallic compositions having phosphorus combined therewith, such metals being employed as possess different degrees of fusibility, so that the mixture, after being heated, forms in the process of cooling a

porous or cellular mass, the pores, or cells, or interstices of which are filled with the more fusible and softer metal (which has become more or less mixed or alloyed with one or more of the harder and less fusible metals) surrounded by the harder or less fusible metal, the latter forming the walls of the cells. The softer or more fusible portion of the mass constitutes the rubbing face which is exposed to friction. The following are the approximate proportions of the compositions:—(a) One half per cent to 3 per cent of phosphorus, 4 per cent to 15 per cent of lead, 4 per cent to 15 per cent of tin; the necessary proportions of copper being in each case added to make up 100 parts. When more than ordinary hardness is desirable in the formation of the cells, the following approximate proportions are used. (b) One quarter per cent to 2 per cent of phosphorus, 4 per cent to 15 per cent of lead, 4 per cent to 15 per cent of tin, 8 per cent to 15 per cent of zinc. The necessary proportions of copper being added in each case so as to make up the 100 parts.

Improvements in the mode of and apparatus for treating phosphates of lime. Edward Primerose Howard Vaughan, F.C.S., patent agent, Chancery Lane, Middlesex. (A communication from Count Haytens de Terbecq, Paris.) May 9, 1874.—No. 1644. The object of this invention is improvements in means and apparatus for facilitating the extraction of the soluble constituents of phosphates of lime for agricultural purposes. The apparatus is composed of a skeleton drum containing the phosphates, and revolving in a trough charged with a mixture of hydrochloric or nitric acid and water, and the product of the operation may either be applied direct after neutralisation as liquid manure, or reduced to a solid state by after-evaporation and treatment by sulphuric acid alone or combined with fertilising salts.

An improvement in process of and apparatus for desilvering and refining lead. Gustave Luce, of the firm of Luce, Son, and Rozan, manufacturers, Marseille, France. May 11, 1874.—No. 1662. This invention relates to improvements in the process and apparatus for refining and desilvering lead, described in C. D. Abel's Specification, No. 3292, of 1869. According to the present invention, air or other compressible gas is employed in place of steam for oxidising the impurities of the lead and producing its ebullition and consequent crystallisation, the air or gas being forced in through a pipe passing horizontally into the cauldron containing the lead near the bottom thereof. The pipe is provided with a cock or valve for regulating or cutting off the supply of air or gas.

Improvements in the production of caustic alkalies and of carbonic acid. John Henry Johnson, Lincoln's Inn Fields, Middlesex. (A communication from Charles Juron, Antoine Imbert, Joannes Juron, and Louis Imbert, all of Paris.) May 11, 1874.—No. 1672. This invention relates to the conversion, on a commercial scale, of alkaline carbonates into caustic alkalies by a dry method, and to the production of carbonic acid; and consists in introducing steam at a suitable pressure into a furnace or tube, in which it is superheated, and then causing such superheated steam to pass through or to come in contact with the mass of carbonate to be converted, such carbonate being placed in its ordinary condition in a receptacle composed of copper or aluminous clay.

Improvements in the manufacture of an artificial fuel from sewage deposits, night-soil, and other dry and moist manurial matters mixed with other materials. Gustav Alsing, Preston, Lancaster. May 12, 1874.—No. 1689. The novelty of my invention consists in utilising sewage deposits, night-soil, and other dry and moist manurial matters, by mixing it with other carbonaceous, deodorising, bituminous, and other suitable material for the purpose of making it into a useful and cheap artificial fuel.

A new system of bleaching, and in the apparatus employed therein. Harold Potter, bleacher, Manchester, Lancaster. May 12, 1874.—No. 1690. My invention consists in placing the yarn or fabric on perforated partitions in a closed vessel capable of resisting a pressure of about 200 lbs. to square inch, and in causing a circulation of hot water through the same at a pressure of about 200 lbs. per square inch, which is kept up until the operation is completed.

MEETINGS FOR THE WEEK.

- MONDAY, Feb. 22nd.—Medical, 8.
— London Institution, 5.
— Geographical, 8.30.
— Society of Arts, 8. (Cantor Lectures.) Rev. Arthur Rigg, M.A., "The Material, Construction, Form, and Principles of Tools and Contrivances used in Handicraft."
- TUESDAY, 23rd.—Civil Engineers, 8.
— Anthropological, 8.
— Society of Arts, 8. Mr. Thomas J. Hutchinson, F.R.G.S., F.S.A., "On the Social and Domestic Slavery of Western Africa in its bearing upon Commercial Progress."
— Royal Institution, 3. Alfred H. Garrod, Esq., "On Animal Locomotion."
- WEDNESDAY, 24th.—Geological, 8.
— Society of Arts, 8. Captain Bedford Pim, "On the Mercantile Marine of Great Britain."
- THURSDAY, 25th.—Royal, 8.30.
— Royal Institution, 3. Professor Tyndall, "On Subjects Connected with Electricity."
- FRIDAY, 26th.—Royal Institution, 8. Weekly Evening Meeting. Mr. W. R. S. Ralston, "Popular Tales: their Origin and Meaning," 9.
— Quekett Club, 8.
- SATURDAY, 27th.—Royal Institution, 3. Prof. W. K. Clifford, "On the General Features of the History of Science."

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THE CHEMICAL NEWS

VOL. XXXI. No. 796.

ON THE MANUFACTURE OF CAUSTIC SODA.*

By JOHN MORRISON, F.C.S.

I do not wish to make needless apologies, but, since undertaking to prepare this paper, other duties have pressed so heavily upon me, that I have been obliged to content myself with a much less complete treatment of the subject than was my original desire and intention. As the paper stands, it is but little beyond a revised transcript of a series of rough notes I prepared for a special object some six months ago, when occupied in one of the Lancashire caustic soda works; though as such it will, I believe, be found a thoroughly practical description of the process and plant in general use—certainly nothing more, and I venture to hope, nothing less. That it is not something beyond is, may I say, my misfortune, not my choice; a misfortune which I certainly regret, and my regret is that, possessing the will, I lacked the opportunity of carrying it fully into effect.

I have frequently lamented the apparent absence of identity about the status of a chemical works manager. It seems quite a question whether our calling ought to rank as a profession, or whether we do not rather belong, plainly and simply, to a superior order of works detective. We are a class of men called into existence, as most other classes of men, by Mother Necessity, but occupying a somewhat abnormal position (I do not speak of the Tyne especially); and, probably from the peculiarity and the variable character of our employment, there has not yet been devised any special course of training for aspirants to our office.

Most of us are of laboratory descent—men who, with a strong love to the calling of our choice, have early yielded to the discovery that we could never look to analytical chemistry otherwise than as a sort of *pis-aller*—a kind of out-at-elbows trade—forming simply a stepping-stone to an indefinite something better. That at first undefined something, however, speedily resolved itself into a managership; and a managership, therefore, became henceforth the summit of our most ardent hopes. Educated, then, in such a way, it is not surprising that some of us experience an occasional hankering after laboratory work, though, unfortunately, our longings are rarely unaccompanied by vague misgivings that we are pandering to a kind of mortal sin that must be eschewed, or that the work is a sort of happy pastime which to us, for our offences, is for ever proscribed. In fact, many of us have gradually taught ourselves to look upon the laboratory almost in the light of a necessary nuisance, an institution only of use to ascertain if we get full value in our raw materials, and that our finished products are sent out up to strength. Henceforward, we have said to ourselves, our chemistry must be confined to productions and costs per ton, and, in Lancashire especially, to quantity turned out per furnace; the best manager being he who, *prima facie*, can get the greatest number of tons out of a given number of men and a given amount of plant.

But our early laboratory training, if sufficient to carry us in safety over many quicksands, was, perhaps, one of the very worst to fit us for the miscellaneous duties of our new sphere of labour; for while, as it seems to me, the chemist is perpetually living in the visionary future, the manager must ever be occupied with the business of today. In many things he has to act more by a sort of instinct or intuition, than by the more philosophical methods

of reasoning peculiar to the chemist; building up, by a close observance of men and things, a kind of stock-in-trade of ideas, commonly called practical experience, and from the latter, to him, infallible source, often arbitrarily enough deducing his own peculiar theories. His leading maxim is, an ounce of wit equals considerably over a pound of ability; so as often as not, he cultivates his wits as a most tender plant, and leaves ability to come up as a weed taking care of itself. And after all, as some one has observed, it is not the men of ability who are the most successful, but those who can concentrate the most faculties—which, I take it, are pretty much the same as wits—upon a given subject.

This practical experience (either our own or some one else's) is, I imagine, as a general rule, the safest basis on which to act; for speculative theorising is dangerous ground, and, to nine men out of every ten who indulge in it, a species of gambling, which may, indeed, cast up in their favour, but will more probably go against them. It is much safer, in short, to act the sheep, and copy the good points of our neighbours, than to assume the shepherd, and be continually plunging into untried paths; for in the one case if we go wrong, we can generally saddle the blame on others, while in the other we must bear, in a world where the only test of merit is success, the brunt of failure ourselves.

There is nothing, I am persuaded, stands a manager in such good stead as simple, practical, discriminating common sense, united to the faculty of discerning intuitively the relation between a given cause and its probable effect. Any man can detect a leakage in a pipe, or a vat, or a settler; but not every man can at a glance trace its result, and distinguish between a trivial defect, the repair of which may serve the fitter as a stock-job, and an important one which, if neglected, may lose many pounds.

It is, I believe, possible, strange as to some it may appear, for a manager to be too much of the chemist, and to sigh too earnestly after maximum productions. Splendid productions—that is, very high percentages—from salt-cake, or sulphur ore, or anything else, may be dearly purchased. Twenty middling black-ash balls per shift per furnace, for instance, would, I am inclined to think, really pay better than fourteen or fifteen first rate ones, containing a minimum amount of sulphate on alkali, in spite of worse produce shown in the process book, for it must never be overlooked that it is really quantity turned out, and not so much “production” that makes a works pay. Indeed, if a manager keep up his tonnage per week or month to the maximum standard, the process book may, as a general rule, be left pretty much to look after itself.

To no department of the alkali manufacture is this doctrine more applicable than to that of caustic soda. Essentially a branch which, to pay well, must be worked at the very highest possible pressure, it is one to which the slow and sure theory must not for a moment be applied, and a manufacture likewise in which, without any excess of chemistry, there must be the most searching, constant, and energetic supervision; and with such supervision the whole process lies in a nutshell.

To achieve the best results, two things are necessary—first, that the plant be well proportioned and in sound condition, and secondly (as I have just hinted) that it be worked to the very best advantage. The latter especially, for in an alkali works whether small or large, there are certain what may be termed fixed expenses, such as foremen, mechanics, and clerks, and these charges with a small turn out, become as we all know very serious. It is a capital thing to bring as frequently as possible all expenses to terms of per ton of alkali produced, for we are never, as it seems to me, so well able to plan out reductions on working costs, &c., or to study the effects of modifications or fancied improvements, as when face to face with our actual position stated in terms which we can comprehend at a glance. But my preface has reached a greater length than I intended.

* A Paper read before the Newcastle-upon-Tyne, Chemical Society.

The literature of caustic soda seems singularly scant, for, excepting through the medium of stray notes in scientific journals, there does not exist, so far as I am aware, any detailed description of the manufacture of white caustic soda as carried on at the present time. There were, I believe, no samples of this article in the Exhibition of 1851, so that the industry is one of comparatively recent date, and rather strangely, the process is confined almost entirely to the Lancashire districts. Why it does not work equally well on the Tyne, I can I think, after an inspection of some of the appliances in use, imagine; though that the sole cause is the inferiority of "Tyne" chalk to "Lancashire" limestone I am slow to believe; and that its manufacture could be made with suitable plant to yield a fair margin of profit, I feel pretty confident. It is a current belief however here, that caustic soda is chiefly produced from "red" liquors, but that nothing can be further from the truth, I think the details I am about to give will amply prove. Good white caustic soda from "red" liquors alone is, I fear, almost an impossibility in the present state of manufacturing experience.

It will be scarcely necessary to describe the properties of caustic soda. Its digestive powers are well known to be of the very highest order, and its especial fondness for delicate portions of the cuticle, the fingers and faces of those of us who have had much to do with it, have often painfully attested. Linen or cotton clothes resist its action much better than woollen ones, a fact which is taken advantage of by most of the workmen who have to deal with it. It is very cleanly in its habits. It abhors dirt quite as intensely as nature abhors a vacuum, and like a certain well-known quadruped—loveliest perhaps in death—it is not so particularly disagreeable when kept strictly clean, but if carelessly neglected, it has a tendency to become an insufferable nuisance. Of all messes, a caustic one is perhaps the worst. A manager under its influence is sincerely to be pitied, and should he, in accordance with his natural temperament, become either persistently morose or energetically frantic, it is better to move quietly out of his way, for while he is worthy of your utmost sympathy, you can rarely be of much service. Cleanse therefore all pans from scale and limy sediment every few weeks. Never mind the trouble; for if this you neglect, an evil day, though long deferred, will surely and perhaps suddenly come.

I think for the sake of clearness, I should like to complete the task before me under three distinct headings. The first to include a general description of the plant in common use in Lancashire; the second to embrace the practical details of the manufacture; and the third to consist of analysis, costs, and miscellaneous observations.

(To be continued.)

ANALYSIS OF THE AIRTHREY SPRINGS AT BRIDGE OF ALLAN.

By WILLIAM JOHNSTONE.

THE mineral springs of Airthrey have been known to exist from a remote period. The workings of a copper mine on the Airthrey estate led to their discovery.

There are four springs in the mine about 300 yards from the bottom of the shaft. Three of the springs are collected in a cistern immediately under the shaft, and by means of a lead pipe and force-pump the water is raised 30 fathoms, and then conveyed to the well-house. The flow of water is about 1000 gallons in the 24 hours.

The following is the result of the analysis of a sample of the water taken from the storing tank at 1 p.m. on the 7th March, 1874, immediately after the engine had stopped pumping.

Temperature of the water 48° F.
Temperature of the atmosphere 62° F.
Specific gravity of the water at 60° F. .. 1.00865

Sulphuric anhydride	0.02373	Sodium ..	0.01364
"	0.24581	Calcium ..	0.12290
"	0.00332	Strontium ..	0.00363
Chlorine	2.69376	Sodium ..	1.74636
"	2.10302	Calcium ..	1.28389
"	0.00460	Magnesium	0.00155
"	0.02615	Potassium	0.03002
Bromine	0.00296	Magnesium	0.00050
Carbonic dioxide ..	0.00685	Magnesia ..	0.01274
"	0.00104	Ferrous oxide	0.00142
"	0.06985	Lime	0.08890
Phosphoric anhydride	0.00026	"	0.00023
Total acids, &c. ..	5.18135	Total bases, &c.	3.30578

The water also contains traces of manganese, copper, lithium, barium, and iodine.

The water contains the following gases expelled by boiling—

1 litre contains	21.890 c.c.
Oxygen	4.326
Nitrogen	10.832
Carbonic dioxide	6.732

21.890

The above results expressed in grammes per litre:—

Sodium chloride	4.44184
" sulphate	0.04213
Calcium chloride	3.28782
" sulphate	0.41788
" carbonate	0.15876
" phosphate	0.00034
Strontium sulphate	0.00763
Magnesium chloride	0.06160
" bromide	0.00386
" carbonate	0.02678
Potassium chloride	0.05498
Ferrous carbonate	0.00276
Silica	0.00203
	8.50841

Total residue dried at 356° F. ..	8.48713
Volatile and organic matter	0.01326

Total solid residue in 1 litre .. 8.50039

9, Royal Terrace, Edinburgh.

ON THE VALUE OF THE SO-CALLED CHAMELEON BAROMETER, AS AN HYGROMETER.

By A. PERCY SMITH, F.C.S.

A PIECE of bibulous paper soaked in cobaltous chloride, is blue when dry and red when moist, and I have found it very sensitive to slight changes in the quantity of moisture in the atmosphere.

A paper, prepared as above, was suspended in a room on the wall, facing a south window, which was kept open during the day. By its side were two thermometers, wet and dry bulb, reading to 2° F.

Observations were made three or four times a day for nearly a year.

The colour of the paper was estimated at from 0 (red) to 10 (blue).

I adjoin some of the readings taken. More are unnecessary from their similarity.

It would appear that the *actual* temperature has no appreciable effect on the colour of the paper, as it registers the same, for the same difference between the two thermometers, whether in winter or in summer.

I have found as a general rule that the paper is more sensitive than the thermometers I used, and I think that

such a paper is very convenient, as it enables one to see at a glance whether the air is moist or dry, and even, approximately, to estimate the amount of moisture.

Date.	Dry Bulb.	Wet Bulb.	Difference.	Colour of Paper 0-10.	Remarks.
1874.					
July 8th.					
1.30 p.m.	72.0	60.0	12.0	9.0	Very hot day.
5.30 „	74.0	61.0	13.0	10.0	Paper quite blue.
12.30 „	70.0	59.0	11.0	8.5	
July 10th.					
9.30 a.m.	74.5	65.0	9.5	8.0	Much hotter than 7th or
1.30 p.m.	77.0	67.0	10.0	7.0	8th, yet paper not so
5.30 „	79.0	67.0	12.0	9.0	blue.
Sep. 29th.					
1.30 p.m.	62.0	57.0	5.0	2.0	
Sep. 30th.					
1.30 p.m.	62.0	56.0	6.0	3.0	
8 „	64.0	61.0	3.0	1.0	Barom. falling for rain.
Oct. 1st.					
9.30 a.m.	62.0	58.0	4.0	—	Had rained in night.
10.30 p.m.	63.0	59.0	4.0	1.0	Barom. risen slightly.
Oct. 2nd.					
1.30 p.m.	59.0	55.0	4.0	—	Barom. falling, showery.
6.40 „	58.0	53.0	5.0	1.0	Barom. steady, cleared up.
Oct. 4th.					
1 p.m.	57.0	52.0	5.0	1.0	Fine.
Oct. 5th.					
9 a.m.	55.0	50.0	5.0	2.0	Barom. rising.
Oct. 6th.					
1.30 p.m.	53.0	50.0	3.0	—	Barom. falling, wet night.
Oct. 20th.					
9 a.m.	55.0	50.0	5.0	1.0	Fine morning.
8 p.m.	60.0	59.0	1.0	—	Barom. fell $\frac{3}{4}$ -inch, very stormy night.
Oct. 23rd.					
1.30 p.m.	52.0	48.0	4.0	1.0	Wind N.
6.30 „	55.0	54.0	1.0	—	Wind W.
Dec. 3rd.					
10 p.m.	43.0	40.0	3.0	2.0	Sharp frost.

Rugby, Feb. 12, 1875.

ON THE
DEGRADATION OF THE COLOUR OF
VERMILLION, OCCASIONED BY CONTACT
WITH COPPER AND BRASS.

By K. HEUMANN.

SOME years ago Karmarsch (*Ding. Polyt. Journal*, cxxxvi., p. 153), investigated the circumstance that if copper plates are employed in printing vermillion, the impressions are generally brown or blackish. In the manufacture of playing-cards it has also been observed that if brass is used in grinding up the colour, its beauty is seriously impaired, the red becoming at first brownish, and very soon deep-brown and utterly useless. Karmarsch perceived at once that this change of colour depended in the formation of copper-sulphide, but supposed that the requisite sulphur was derived from impurities in the vermillion, as a decomposition of the latter under such circumstances, at ordinary temperatures, is highly improbable, and as chemical manuals furnish nothing analogous.

The author having recently shown* that this decomposition of vermillion, though at that time regarded as highly improbable, actually occurs regards Karmarsch's proposal, to boil the vermillion before use in a solution of pure

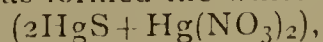
potash, as useless, and has therefore repeated the experiments of the latter chemist.

The author had at his disposal a very pure vermillion, perfectly free from metallic mercury, which, when boiled with solution of potash, left it quite colourless, and yielded to it no demonstrable traces of sulphur. Nevertheless a bright plate of copper or brass was immediately coated with black copper-sulphide, if the vermillion—previously extracted three times with fresh potash-lye and then washed—was rubbed upon it with a cork. Perfectly dry vermillion requires a somewhat strong pressure to produce this effect. If it is previously rubbed up to a paste with water, pressure with the finger is sufficient to blacken the copper. On stronger friction with a cork, a part of the black coating becomes separated from the metal, mixes with the rest of the vermillion, and gives it a blackish colour; whilst the copper where it has been in contact with the vermillion is strongly amalgamated. It is even possible to write upon copper or brass with a piece of sublimed vermillion, the characters appearing silvery white after the metal has been rinsed in hydrochloric acid. The ready decomposability of vermillion, as shown by this experiment, cannot be removed by boiling in potash. Karmarsch, however, declares that commercial vermillion may be freed by two methods from those sulphur compounds which, in his opinion, cause the formation of copper sulphide:—first, by boiling with potash lye; and secondly, by stirring up the vermillion to a paste with water, and introducing pieces of metallic copper, which were to seize upon the sulphur, and thus deprive the vermillion of the power of blackening any further quantity of copper.

This result can only be explained by assuming that in his experiments qualities of vermillion were used which really contain soluble sulphur, by which the copper was affected, whilst the vermillion was not in such close contact therewith as to undergo decomposition. Following Karmarsch, the author laid a bright copper coin for some time in a paste of vermillion and water, and found, on rinsing it, that the metal was really almost unchanged. Those places only which had been accidentally touched with a glass rod, in stirring up the mixture, were blackened. Wherever the copper had come in collision with the side of the vessel within the paste, thus occasioning close contact between the metal and the vermillion, blackening and amalgamation of the metal were manifest. The results of Karmarsch's experiments are possible only if the pieces of copper remained motionless in the colour paste, and thus were able to take up merely free or dissolved sulphur.

As in printing, &c., with vermillion, the contact necessary for the decomposition of the metal occurs; the degradation of the colour cannot be prevented by previous boiling with potash. Vermillion rubbed up with oil is much less readily attacked than if dry or mixed with water. Iron decomposes vermillion only at elevated temperatures, and can therefore be used for rubbing and grinding without injury to the colour. Zinc has a very slight decomposing action if rubbed with vermillion, and the zinc sulphide, if formed, is white—the change of the red colour is scarcely perceptible.

Karmarsch states, in a note to his Memoir, that extraction with potash lye is not to be recommended for all sorts of vermillion. One sample was rendered decidedly brown by this process. A sample of vermillion prepared in the moist way was sought to be freed from an admixture of metallic mercury by boiling with dilute nitric acid, in consequence of which it assumed a lighter colour, and, on subsequent treatment with caustic or carbonated alkalis or ammonia, it became a deep black. In consequence of the action of mercuric nitrate upon a portion of the vermillion there was formed the white compound—



which made the red colour rather paler, and, on decomposition with alkalis, yielded a black mixture of mercuric oxide and mercuric sulphide.—*Ber. der Deutsch.*

* *Annal. Chem. Pharm.*, bd. clxxiii., p. 21. *Berichte*, vii., p. 753.

SOCIETY OF PUBLIC ANALYSTS.

"SALE OF FOOD AND DRUGS ACT, 1875."

THIS Bill being, of course, at the present moment a matter of considerable interest to our readers, we reprint its full text, and also as much of the discussion on the second reading as our space will admit of, and we only regret that we have not sufficient room for a verbatim report of the various speeches, which, had it been possible, we should have had much pleasure in publishing. However, we must content ourselves with referring our readers to so much of the debate as is to be found in our columns, and particularly to the speech of Dr. Lyon Playfair, which displays perhaps a greater knowledge of the subject, and a juster appreciation of the position of the Public Analysts, than that of any other speaker.

It will be at once obvious to all Analysts that the Bill, as it stands, contains some clauses which—if allowed to remain unaltered—would render it retrogressive, if not absolutely nugatory.

To the modification or removal of these objectionable clauses the Council of this Society has devoted itself, and though it is impossible to say *exactly* what alteration the Government will make, until the Bill appears in Committee on the 4th proximo, we have the satisfaction of knowing from Mr. Sclater-Booth that all our suggestions will be carefully considered, and many of them certainly accepted.

Amongst the points we have specially urged on the Government we may mention the following:—

That in the 3rd Section the words "Every article of food or drink" should be substituted for the words "Every article eaten or drunk," the latter phraseology, though its meaning may be perfectly plain, yet being open to the plausible argument that certain substances—such, for instance, as tea, coffee, &c.—are, in their natural state, neither "eaten" nor "drunk."

That in Section 6 the word "knowingly" should be omitted from the first line, as its retention—as the experience of our readers will confirm—would render a conviction impossible, the proof of guilty knowledge on the part of the vendor being out of the question. We also objected to the words "according to the usage of trade," in the third exception under this same Section, and we contend that the admission of such a phrase would be a direct incentive to adulterate, for it is clear it would be only necessary to prove that some given adulteration was *extensively* practised to render it legally allowable.

In subsequent Sections we also demurred to the words "the usage of trade," as in every case opening the door to further adulteration.

In Section 9 we urge the excision of the word "knowingly," for the same reason as in Section 6.

Section 12 we propose to make read somewhat thus:—"Any purchaser of any article of food, in any district, county, city, or borough, where there is any Analyst appointed, shall be entitled, on payment to the Analyst—or if there be no such Analyst then acting for the district, then to the Analyst of a neighbouring district—of such sum as shall be agreed upon between such person and the Analyst, to have such article analysed," &c.

The importance of the omission of the words "ten shillings and sixpence" will be at once apparent, and we have reason to think that on this point the Government will give way.

In Section 13 we contend that when an Inspector, employed for the express purpose of purchasing samples for analysis, has purchased such samples, he shall, as a part of his duty, at once take the same to the Analyst. To allow him any discretion on this point appears to us absurd, and we do not understand how such a clause has crept into the Bill.

In Section 14, as a natural sequence, we also propose

the omission of the words "if he deem it right to have the article analysed."

In Section 21 we suggest the insertion of a provision that the Analyst *shall* be paid a fee for every attendance in Court, and this we believe will be agreed to.

To Section 22, as it stands, we have the strongest objection; but the substitution of the word "another" for "adjoining," in the fourth line, and the elimination of the words "who shall thereupon make the analysis as if he were applied to by any officer in his district," we think will at any rate render the clause innocuous.

In Section 25 we have pointed out the absence of any provision for prosecuting the wholesale dealer who may have given a warranty of the purity of an article which is found to be adulterated, but for which the retailer cannot be punished, in consequence of his possession of such false warranty.

There are various other points to which we have directed the attention of the Local Government Board, but to which we have not here space to allude. We hope, however, to return to the subject next week; and though the Bill, as drafted, was certainly a most unpromising one, we yet hope that in Committee it may be purged from its most glaring blots, and be made a useful and practical measure. We may, at any rate, add that no efforts on our part for the arrival of this "consummation most devoutly to be wished" will be wanting,

The following is the text of the above named Bill, which was read a second time in the House of Commons on Friday, the 19th instant; it bears the names of Mr. Sclater-Booth and Mr. Clare Sewell Read, the President and Secretary of the Local Government Board, and the House will go into Committee on it on Thursday, March 4th:—

WHEREAS it is desirable that the Acts now in force relating to the adulteration of food should be repealed, and that the law regarding the sale of food and drugs in a pure and genuine condition should be amended:

Be it therefore enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1. From the commencement of this Act the 23 & 24 Vict., c. 84, 31 & 32 Vict., c. 121, s. 24, and the 35 & 36 Vict., c. 74, shall be repealed, except in regard to any appointment made under them and not then determined, and in regard to any offence committed against them or any prosecution or other act commenced and not concluded or completed, and any payment of money then due in respect of any provision thereof.

2. This Act shall not apply to Scotland or Ireland except as herein provided.

3. The term "food" shall include every article eaten or drunk by man, other than drugs:

The term "drug" shall include medicine for internal or external use:

The term "county" shall include every county, riding, and division, as well as every county of a city or town, not being a borough:

The term "justices" shall include any police and stipendiary magistrate invested with the powers of a justice of the peace.

Description of Offences.

4. No person shall knowingly mix, colour, stain, or powder, or order any other person to mix, colour, stain, or powder, any article of food with any ingredient or material of a nature injurious to health, with intent that the same may be sold in that state, and no person shall knowingly sell any such article so mixed, coloured, stained, or powdered, under a penalty in each case of *fifty* pounds for the first offence; every subsequent offence, after a conviction in such penalty, shall be a misdemeanour, for which the person, on conviction, shall be imprisoned for a period not exceeding six months with hard labour.

5. No person shall knowingly, except for the purpose of

compounding as hereinafter described, mix, colour, stain, or powder, or order any other person to mix, colour, stain, or powder, any drug with any other ingredient or material of a nature injurious to health, with intent that the same may be sold in that state; and no person shall knowingly sell any such drug, so mixed, coloured, stained, or powdered, under the same penalty as in the last clause for a first and subsequent offence.

6. No person shall knowingly sell any article of food or any drug which is not of the nature, substance, and quality of the article demanded by the purchaser, under a penalty of *twenty* pounds, except as herein excepted and provided; that is to say, except—

Where any matter is mixed therewith for the purpose of rendering it portable, or of preserving it;

Where a harmless ingredient is mixed with it for the purpose of rendering it palatable or of improving its appearance;

Where according to the usage of trade it is sold in a mixed state;

Where it is the subject of a patent in force, and is supplied in the state required by the specification of the patent;

Where British, colonial, or foreign spirits are reduced from their ordinary strength by persons licensed and paying duties under the excise;

Where a drug is compounded either in conformity with a prescription of a registered medical practitioner or otherwise, according to the usage of trade;

Where the article is unavoidably mixed with some extraneous matter.

7. No person shall sell any article mixed for any of the purposes mentioned in the exceptions above set forth, if the matter mixed be more than is ordinarily required for the purpose, under a penalty of *ten* pounds.

No person shall sell any article of food which by the usage of trade is sold in a mixed state, unless the ingredients shall be mixed in the proportions required by such usage, and no person shall sell any compounded drugs, except the same shall be compounded according to the prescription in writing submitted for that purpose, or in accordance with the regulations prescribed by the British Pharmacopœia issued by the General Medical Council, or with a basis to be laid down by the Pharmaceutical Society, or the Local Government Board, or the Privy Council, subject to a penalty of *twenty* pounds.

8. Provided that no person shall be guilty of an offence in respect of the sale of an article mixed with any ingredient not injurious to health, whether the case may or may not fall within any of the above mentioned exceptions, if at the time of delivering such article he shall supply to the person receiving the same a notice to the effect that the article is mixed, by a label written or printed on or with the article.

9. No person shall knowingly, and with the intent that the same may be sold in its altered state without notice, abstract from an article of food any part of it so as to affect injuriously its quality, substance, or nature, and no person shall knowingly sell any article so altered without making disclosure of the alteration, under a penalty in each case of *ten* pounds.

Appointment and Duties of Analysts, and Proceedings to obtain Analysis.

10. In the City of London and the liberties thereof, the commissioners of sewers of the City of London and the liberties thereof, and in all other parts of the Metropolis the vestries and district boards acting in execution of the Act for the better local management of the Metropolis, the court of quarter sessions of every county, and the town council of every borough having a separate court of quarter sessions, or having under any general or local Act of Parliament or otherwise a separate police establishment, may, as soon as convenient after the passing of this Act, where no appointment has been hitherto made, and in all cases as and when vacancies in the office occur, and

when required so to do by the Local Government Board, shall, for their respective city, districts, counties, or boroughs, appoint one or more persons possessing competent knowledge, skill, and experience, as Analysts of all articles of food and drugs sold within the said city, metropolitan districts, counties, or boroughs, and shall pay to such Analysts such remuneration as shall be mutually agreed upon, and may remove him or them as they shall deem proper; but such appointments and removals shall at all times be subject to the approval of the Local Government Board, who may require satisfactory proof of competency to be supplied to them, and may give their approval absolutely or with modifications as to the period of the appointment and removal, or otherwise.

11. The town council of any borough may agree that the analyst appointed by any adjoining borough or for the county in which the borough is situated, shall act for their borough during such time as the said council shall think proper, and shall make due provision for the payment of his remuneration, and if such Analyst shall consent, he shall during such time be the Analyst for such borough for the purposes of this Act.

12. Any purchaser of any article of food in any district, county, city, or borough where there is any Analyst appointed under this or any Act hereby repealed shall be entitled, on payment to the Analyst, or if there be no such Analyst then acting for the district to the Analyst of a neighbouring district, of a sum not more than ten shillings and sixpence, as shall be agreed upon between such person and the Analyst, to have such article analysed by such Analyst, and to receive from him a certificate of the result of his analysis.

13. Any medical officer of health, inspector of nuisances, or inspector of weights and measures, or any inspector of a market, or any police constable under the direction and at the cost of the local authority appointing such officer, inspector, or constable, may procure any sample of food, or drugs, and if he suspect the same to have been sold to him contrary to any provision of this Act, shall submit the same to be analysed by the Analyst of the district or place for which he acts, and such Analyst shall with all convenient speed analyse the same and give a certificate to such officer, wherein he shall specify the result of the analysis.

14. The person purchasing any article with the intention of submitting the same to analysis shall, after the purchase shall have been completed, notify to the seller or his agent selling the article his intention to have the same analysed by the Public Analyst, and shall offer to divide the article into three parts to be then and there separated, and each part to be marked and sealed, or fastened up in such manner as its nature will permit, and shall, if required to do so, deliver one of the parts to the seller or his agent.

He shall afterwards retain one of the said parts for future comparison, and submit the third part, if he deems it right to have the article analysed, to the analyst.

15. If the seller or his agent do not accept the offer of the purchaser to divide the article purchased in his presence, the Analyst receiving the article for analysis shall divide the same into two parts, and shall seal or fasten up one of those parts, and shall cause it to be delivered, either upon receipt of the sample or when he supplies his certificate to the purchaser, who shall retain the same for production in case proceedings shall afterwards be taken in the matter.

16. If the Analyst do not reside within two miles of the residence of the person requiring the article to be analysed, such article may be forwarded to the Analyst through the post office as a registered letter, subject to any regulations which the Postmaster General may make in reference to the carrying and delivery of such article, and the charge for the postage of such article shall be deemed one of the charges of this Act or of the prosecution, as the case may be.

17. If any such officer, inspector, or constable, as above described, shall apply to purchase any article of food or

any drug exposed to sale, and shall tender the price for the quantity which he shall require for the purpose of analysis, not being more than shall be reasonably requisite, and the person exposing the same for sale shall refuse to sell the same to such officer, inspector, or constable, such person shall be liable to a penalty of *five* pounds.

18. The certificate of the analysis shall be in the form set forth in the schedule hereto, or to the like effect.

19. Every Analyst appointed under any Act hereby repealed or this Act shall report quarterly to the authority appointing him the number of articles analysed by him under this Act during the foregoing quarter, and shall specify the result of each analysis, and such report shall be read at the next meeting of the authority appointing such Analyst.

Proceedings against Offenders.

20. When the Analyst having analysed any article shall have given his certificate of the result, from which it may appear that an offence against some one of the provisions of this Act has been committed, the person causing the analysis to be made may take proceedings for the recovery of the penalty herein imposed for such offence, before any justices having jurisdiction in the place where the article or drug sold was actually delivered to the purchaser, in a summary manner.

Every penalty imposed by this Act shall be recovered in the manner prescribed by 11 & 12 Vict., c. 43, and may be mitigated according to the judgment of the justices.

21. At the hearing of the information in such proceeding the production of the certificate of the Analyst shall be sufficient evidence of the facts therein stated, unless the defendant shall require that the Analyst shall be called as a witness, and the parts of the articles retained by the person who purchased the article shall be produced, and the defendant may, if he think fit, tender himself and his wife to be examined on his behalf, and he or she shall, if he so desire, be examined accordingly.

22. The justices before whom any complaint may be made under this Act may, upon the request of either party, in their discretion cause any article of food or drug to be examined and analysed by the Analyst of an adjoining district, who shall thereupon make the analysis as if he were applied to by any officer in his district, and may be required to attend to give evidence at the hearing of the case; and the expense of such examination, analysis, and attendance shall be deemed part of the expenses of executing this Act, unless the justices order the same to be paid by the complainant or the defendant.

23. Any person who has been convicted of any offence punishable by any Act hereby repealed or this Act by any justices may appeal to the next general or quarter sessions of the peace which shall be held for the city, county, town, or place wherein such conviction shall have been made after the expiration of ten days from the day when such conviction shall take place, provided that such person enter into a recognisance within three days next after such conviction, with two sufficient sureties, conditioned to try such appeal, and to be forthcoming to abide the judgment and determination of the court at such general or quarter sessions, and to pay such costs as shall be by such court awarded; and the justices before whom such conviction shall be had are hereby empowered and required to take such recognisance; and the court at such general or quarter sessions are hereby required to hear and finally determine the matter of such appeal, and may award such costs to the party appealing or appealed against as they shall think proper.

24. In any prosecution under this Act, where the fact of an article having been sold in a mixed state has been proved, if the defendant shall desire to rely upon any exception or provision contained in this Act, it shall be incumbent upon him to prove the same.

25. If the defendant in any prosecution under this Act prove to the satisfaction of the justices or court that he sold the article in the same state as when he himself

purchased it, and that he bought it, as the same article in nature, substance, and quality as that demanded of him, and with a warranty in writing to that effect, he shall be discharged from the prosecution, but no order for costs shall be made in the case, unless he shall raise any other question which shall be decided against him, in which case he shall be liable to pay the costs incurred by such question.

26. Every penalty imposed and recovered under this Act shall be paid in the case of a prosecution by any officer, inspector, or constable, to the prosecutor, and shall be by such prosecutor paid to the authority for whom he acts, and be applied towards the expenses of executing this Act.

27. Any person who shall forge, or shall utter, knowing it to be forged for the purposes of this Act, any certificate or any writing purporting to contain a warranty, shall be guilty of a misdemeanour, and be punishable on conviction by imprisonment for a term of not exceeding *two* years with hard labour.

28. Nothing in this Act contained shall affect the power of proceeding by indictment, or take away any other remedy against any offender under this Act, or in any way interfere with contracts and bargains between individuals, and the rights and remedies belonging thereto.

Expenses of Executing the Act.

29. The expenses of executing this Act shall be borne in the city of London and the liberties thereof, out of the consolidated rates raised by the Commissioners of Sewers of the City of London and the liberties thereof, and in the rest of the metropolis out of any rates or funds applicable to the purposes of the Act for the better local management of the metropolis, and in counties out of the county rate, and in boroughs out of the borough fund or rate.

Special Provision as to Tea.

30. From and after the first day of January, one thousand eight hundred and seventy-six, all tea imported as merchandise into and landed at any port in Great Britain or Ireland shall be subject to examination by persons to be appointed by the Commissioners of Customs for the inspection and analysis thereof, for which purpose samples may, when deemed necessary by such inspectors, be taken and with all convenient speed be examined by the Analysts to be so appointed; and if upon such analysis the same shall be found to be unwholesome, mixed with other substances or exhausted tea, the same shall not be delivered unless with the sanction of the said Commissioners, and on such terms and conditions as they shall see fit to direct, either for home consumption or for use as ships' stores or for exportation; but if on such inspection and analysis it shall appear that such tea is, in the opinion of the Analyst, unfit for human food, the same shall be forfeited and destroyed or otherwise disposed of in such manner as the said Commissioners may direct.

31. Tea to which the term "exhausted" is applied in this Act shall mean and include any tea which has been deprived of its proper quality, strength, or virtue by steeping, infusion, decoction, or other means.

32. This Act shall commence on the *first day of October, one thousand eight hundred and seventy-five*.

33. This Act may be cited as "*The Sale of Food and Drugs Act, 1875*."

The second reading of this Bill was moved by Mr. SCLATER-BOOTH. The right hon. gentleman said that the first Act upon this subject was passed in 1860, and was rendered necessary by the frequent complaints of purchasers from retail tradesmen of the injury to which they were subjected by the prevalence of adulteration. That Act was in operation for twelve years, when it was entirely recast under the auspices of his noble friend near him, and the question was mixed up in a great degree with sanitary considerations. In the second Act the

appointment of an analyst was made *quasi*-compulsory on the authorities who had to do with it, and the law had a sanitary object. The language of the Act was founded on the idea of adulteration, which was to be prohibited, not only because it was a fraud upon the purchaser, but also because it was an injury done to the community. But this Act was soon found to be attended in its working with serious difficulties, partly caused by the want of any definition of the word "adulteration" in the Bill. Judges differed, and magistrates were unable to understand what was exactly meant by the word. Again, there were some obscurities in certain operative clauses of the Bill which brought about failure on the one side, and on the other gave rise to serious heartburnings. When he came into office, therefore, he found that though the Act was of so recent a date the time had arrived for re-considering it. Consequently, about a year ago, he asked the House to appoint a Select Committee with a view to some amendments during the last Session of Parliament. He stated to the House at that time that his object in proposing the Select Committee was to mitigate the hardships which were undoubtedly imposed on traders in many cases by the law as it stood, but still more to facilitate and make plain the operation of the law, so that the advantages which the public unquestionably possessed by the existence of those Acts might be preserved to it unimpaired. The report was not in his hands early enough to enable legislation to be pressed on last year. Having to consider the matter during the recess, the first question was whether the new Bill should be laid down on the same lines as the old, and whether the same language should be used in its operative clauses. The experienced draughtsman to whom the preparation of the Bill was entrusted found it impossible with satisfaction to himself, or with any assistance which he (Mr. Sclater-Booth) could give, to frame such a definition of the word "adulteration" as could be relied upon as the basis of permanent legislation on the subject. The consequence was, that what would be regarded as the operative clauses of the Bill had been drawn up in a different way, and an attempt had been made to lay down in the clauses the things exactly prohibited, and the exceptions which might fairly release the trader from penalty. The Bill was arranged in five parts; it described the offences prohibited, laid down rules for the appointment and duties of analysts, and regulated the proceedings against offenders; then there were some special provisions with regard to certain offences, and some important clauses with reference to the new duties imposed on those who were to carry out the measure. It prohibited the admixture with food and drugs of any ingredient injurious to health, or the sale of any article not of the nature demanded by the purchaser, with certain exceptions. It was provided that if articles were mixed, whether in accordance with the custom of trade or the convenience of the consumer or seller, they should be mixed in proper proportions, and it would be for the seller to show that. Under the old Act, the seller of retailed articles was obliged to declare orally to his customers if there had been any admixture. That provision had been seriously complained of, and it was obvious that in any shop where a large business was done, this express notice could not be given or insisted on. It was therefore now proposed that it would be sufficient if a label stating the fact was affixed to the article. The Select Committee had recommended that the appointment of analysts should be made compulsory on the authorities. But there were objections to such a course. In the first place the number of candidates for these appointments were not very considerable, and great difficulty had been experienced in getting competent analysts. Then, though you might make an authority appoint an officer, you could not without stringent legislation make him put the officer in motion. He knew from the experience he had in other branches of administration how easy it was to make a colourable appointment and then to take care that the person appointed should not do that which the law contemplated. Further, he did not

think it advisable that the appointments should be too numerous if a smaller number would be sufficient. It was clearly desirable that a small borough, for instance, should have inducements held out to appoint the same person as had been appointed to a large borough or town in the same county to discharge the duties rather than to have separate analysts for each separate town. A refusal on the part of a dealer to allow samples of his goods to be taken for analysis was made a punishable offence. As a matter of common justice, the dealer and his wife would be admitted to give evidence at their trial. This led him to a provision to which he had given anxious consideration—namely, that if the defendant in any prosecution produced a warrant of the purity of the article from the person of whom he had bought it, and also proved to the satisfaction of the justices that he sold it in the same state as when it came into his hands, he should be discharged. Proceedings, however, might be taken against the person who had given such a warrant in the event of the article proving to be adulterated. The fines obtained from prosecutions would in future go to the authorities who were charged with the carrying out of the Act, instead of to the police, and it was hoped that this would prove an inducement to those authorities to have the provisions of the Act strictly enforced. There was an important provision that tea should be examined by the Customs on importation. Any tea pronounced by the Customs' analyst to be unfit for human consumption would be forfeited and destroyed. Altogether, he believed that if the Act was properly enforced the adulteration of food and drugs would be reduced within very narrow limits. Already analysts had been appointed in 34 out of 54 counties, and he had no doubt that under the present Bill the number of such appointments would be largely increased. The Committee were strongly of opinion that mixtures of coffee, cocoa, mustard, &c., which were expressly labelled as mixtures, should be allowed for the sake of the public taste, and their recommendation on this point had been adopted in the Bill. If the consumer desired those articles mixed, and they were harmless, there seemed no reason for prohibiting their sale. At prosecutions it would not be necessary for the analyst to attend unless his presence was expressly desired, and samples for analysis might be sent through the post. A body of gentlemen representing the public analysts had, he was happy to say, expressed approval of the general principles of the Bill, though of course they had suggestions to make in their own interest, some of which he should be able to accept. He hoped the local authorities would take steps to secure prompt execution of the Bill in case it passed into law, and at the same time to ensure fair hearings for all persons concerned in cases of prosecution. He believed the provisions contained in the measure would tend to the great advantage of the public, and would at the same time do no real harm to the trading classes. All the clauses of the Bill had been carefully drawn and considered with a sole desire to provide an effective security for the purchasing public, and at the same time to remove what was a reproach to the existing law—namely, that it was gratuitously injurious to the trading classes. The right hon. gentleman concluded by moving the second reading of the Bill.

Mr. SANDFORD thought this Bill was framed rather in the interest of the wholesale dealer than in the interest of the public. Under the present Act adulteration had been reduced to a *minimum* quantity; but if they were going to return to the old state of things, and to require knowledge on the sale of adulterated articles, then he said they were going to re-establish the state of things which existed twenty-two years ago, and which shocked the public when it was exposed before the Committee that sat. He was quite sure his right hon. friend would be only too anxious to attend to any suggestions that might be made. He would venture to put on the paper some suggestions, and he had only to request that his right hon. friend would not fix too early a day for going into Committee on this Bill.

Mr. MUNTZ observed that the Bill contained a clause specially providing that the Bill should not apply to Scotland or Ireland. He could not understand why that clause was inserted. The working of the Act seemed to give satisfaction in Ireland. Dr. Cameron, the Analyst for Dublin, was decidedly in favour of the Act; and if he remembered right that gentleman stated that before the Act was put in operation in Dublin to every gallon of milk was added 2 gallons of water, but that since the Act came into operation, the water had disappeared, and the milk was perfectly sound. There was in the Bill another clause which provided that if a defendant proved he had sold the article in the same state in which he had purchased it, and with a warranty in writing to that effect, he should be discharged. The recommendations of the Committee were, that if a warranty in writing were produced by a defendant the case should be adjourned, and that the justices should direct a summons to be issued against the person or persons from whom the defendant had purchased the articles, who, if found guilty of adulteration, should be liable to the penalties imposed. For his own part, he could see no objection to the insertion of a clause embodying those recommendations of the Committee. Certainly the wholesale dealer ought to be held responsible if it were clearly proved that the retailer purchased the articles of him in an adulterated state. If this alteration were made in the Bill it would be a most valuable one.

Mr. PELL said that, under the 10th clause, 10s. 6d. was the outside sum to be paid by a person who required an analysis, and this charge, he maintained, was far too low. He should propose an amendment to remove this *maximum* amount to be paid for an analysis.

Sir H. PEEK said he had been in the tea trade all his life, and he believed that not one ounce in a ton of all the tea which came into England was adulterated here. The examination of tea by sample might be very easily effected. Five samples taken from 1000 lbs. weight would be quite sufficient, and if one of those samples was found to contain matters injurious to the human organs it would not be difficult to ensure its destruction. When the proper time arrived he should be able, on the part of the trade, to show how the bill might be considerably improved.

Mr. GARNIER wished to express his opinion that this Bill would remedy all the grievances of traders, while it gave increased protection to the public. As to the Act of 1872, it was practically a dead letter in the country districts, because the inspectors, who were generally superintendents of police, could not be spared from their other duties to take the samples to the Analyst for examination.

Mr. READ assured the House that the Bill was meant to extend also to Ireland and Scotland, and that that fact would be made, if it did not now, to appear plainly on the face of the Bill in Committee.

Dr. LYON PLAYFAIR—I am perfectly sure that the intention of the Government, in framing this Bill, was to make the law thoroughly just and good. There were two interests which they had to consider. They found that the Act had produced some hardship to trade, and that it also proved, in some respects, injurious to the public. The Acts of 1860, 1867, and 1872 have been very beneficial to the public. Before the Act of 1872 was passed, the usage of the trade, with respect to some of the great staple articles of food, was in a very unsatisfactory state. The ordinary usage of the milk trade was to place 25 per cent of water in milk, while at the same time milk did not contain any substance that was prejudicial to health. That usage was condemned, and now milk can be obtained without any adulteration. Again, the usage with regard to bread was to place alum in flour, and to sell bread to the poor of a very inferior quality made of the adulterated flour. The law has compelled bakers to sell to the poor bread which is pure in quality, and from which they can obtain proper sustenance. The operation of the Acts also drove tea, which was imported in an adulterated condition, to other markets, and required that coffee and mustard, which before had been very much mixed should when

mixed, be labelled; so that the purchaser might at all events know what he was buying. Vinegar, too, which before the passing of the Act was much adulterated, is now to be had in a pure condition. Therefore, as regards some great staple articles of food, very important results have been obtained through the operation of the Acts which have been already passed. Now, what I want the House for a moment to consider is this: Does this Bill, while it relieves traders from certain hardships under which they have laboured, secure to the public the benefits they have derived from the Acts to which I have alluded? My own impression is that it does not, and that, unless it is very greatly altered in Committee, while some of the hardships of which traders have complained will be removed, the public will lose the benefits which they have derived from past legislation. I will now, with the permission of the House, point out some of the clauses which induce me to think that much more serious protection of the public is required than is given by this Bill. I venture to say that this Bill differs very essentially from the Acts of 1860, 1867, and 1872. In all these Acts it was assumed that persons selling articles had a sufficient acquaintance with their business to know whether what they offered to their customers was pure or impure; and by the 24th section of the Act of 1867 it was enacted that the knowledge of the adulteration was to be assumed, unless the contrary were proved by the seller. The seller was deemed to know what he was selling; the responsibility for adulteration was made to rest upon him. There have been several judgments in courts of law in accordance with that view. I will only refer to one of them. Mr. Justice Blackburn laid down this principle in a case of appeal with regard to an adulteration of butter, that the simple fact of an article being sold as butter threw on the seller the responsibility of first ascertaining whether it contained lard or any other article as well as butter. In fact, the whole of the judgments given by the superior courts in reference to such matters assumed that the seller ought to know his business sufficiently to be aware whether an article was adulterated or not. Now, what does the Bill say on this point? It says, in effect, that ignorance, instead of knowledge, is to be assumed. The question raised by the word "knowingly" comes in all through the Bill. A man is to be punished who "knowingly" sells a thing that is adulterated, so that he can save himself by not knowing his business at all. A man need not know his business, whatever it may be. If he sells milk, he need not know whether it contains cream or not; he need not know whether he is selling pure milk or skim milk. For my part, I fear that the use of this word "knowingly" will neutralise, to a great extent, the benefit intended to be secured by the Bill; for how can you establish the fact that the thing was done "knowingly?" A man who undertakes to sell food to the people ought to know whether he sells food or not; but how can that be the case unless he is an expert in the business in which he is engaged? Therefore, I think the introduction of the word "knowingly" is a serious defect in the Bill. Another thing which will enable a seller to drive a coach and four through the Bill is the use made in it of the words "usage of trade." What is the "usage of trade?" Before the Acts to which he had alluded came into operation, it was a usage of trade to sell 25 per cent of water as milk, though in London and many other places milk was sold at a very high price. Again, take the case of drugs. It was the usage of trade to send drugs in the root to the drug-grinder, and, when the drug-grinder sent them back, for the owner to receive exactly the same weight of drugs as there was before. The drug-grinder charged nothing for what he had done. How was the grinder paid? Why, by subtracting a certain proportion of the genuine article, and substituting for it some adulterating substance. That usage was swept away under the operation of the Acts which I have mentioned, but under the term "usage of trade" it may be revived. It was a usage of trade to mix oil of vitriol with vinegar, in order to strengthen it by means of such adulteration. Under the operation of the old

Acts, that usage was destroyed; but, if the Bill passes without amendment on this point, we may see it again. It was a usage of trade to put alum in bread, and I believe that that usage is not unlikely to be renewed if the Bill is not amended. In fact, under the phrase "usage of trade," people would be enabled to drive a coach and four through any part of the Bill; and, unless you alter the Bill in that respect, you will render legislation nugatory, so far as the interests of the public are concerned, whatever may be its effect as regards the interests of the trader. The hon. member for Leicestershire (Mr. Pell) has, I think, hit a blot in the Bill. It is impossible to get a chemical analysis such as is required under this Bill for 10s. 6d., and therefore it would be more correct to say that the consumer would have a right to go and get analysis at the expense of the ratepayers. It would be necessary to have combined areas, with efficient Public Analysts receiving salaries of from £100 to £200 a year; and it would be more accurate to say that the cost of the analysis would be 10s. 6d. *plus* the salary drawn from the ratepayers and paid to the Analyst. My hon. friend the member for Norfolk (Mr. C. S. Read) has stated that, when the Bill was prepared, it was intended that Scotland and Ireland should be included in its operation. The Bill, however, expressly says that nothing in the Act shall apply to Scotland or Ireland, "except as hereinafter provided;" and I find nothing provided in the Bill on the subject. At present, Scotland and Ireland are left out in the cold, although they have derived great benefit from the old measures; but I am sure that a provision will be made in the Bill to remedy any such inconvenience.

Mr. SCLATER-BOOTH—Although I have no right to reply, and I have no wish to question any observations which have been made, yet I trust that I may be allowed to make one or two observations. With regard to the observation of the honourable member for Stafford (Mr. Salt), that the poor man is not considered in this Bill, and that he will not be able to pay an Analyst ten and sixpence for an analysis, of course that is so; but under the provisions of the Bill the police and the public prosecutor of the locality are in duty bound to take care of him in the same way that they are required to see to the due inspection of weights and measures. I am not surprised that many honourable members have commented upon and taken exception to Clause 6, which refers to the usages of trade. I accepted that clause with considerable hesitation, and I will carefully consider whether that which I wish to provide for, and which is the real object of the Bill, is not sufficiently provided for by a subsequent clause. I must admit that the word "knowingly" is used too frequently, and I think that there are two places where it ought to be struck out. It certainly was not intended that this Bill should take from persons in Ireland any advantages they enjoyed before. My honourable friend the member for Leicester has complained that, in addition to the charge of ten shillings and sixpence for analysis, there is a supplementary charge to be raised out of the rates. Well, I cannot help thinking that if any charge on the rates is reasonable, it is a charge of this nature. A single prosecution may have the effect of purifying the practice in the whole town, and on that account it seems to me that if there is any charge that should be made on the rates, this is one. I can assure the House that the various suggestions which have been offered will be all considered by me with the fairest possible spirit, and with every anxiety to make the Bill as perfect as possible. I shall be prepared for some changes. The honourable member for Kendal (Mr. Whitwell) asked me what is proposed to be done under the eighth clause? but I should like to communicate with the Customs before I answer that question.

Dr. LYON PLAYFAIR—Will the right honourable gentleman state when he intends to go into Committee?

Mr. SCLATER-BOOTH—Yes; I would ask the House to go into Committee on Friday next, but if that is too soon I would propose Thursday week.

The Bill was then read a second time, and ordered to be committed on the 4th of March.

CORRESPONDENCE.

ADULTERATION OF FOOD AND DRUGS ACT.

To the Editor of the Chemical News.

SIR,—In the new "Adulteration of Food and Drugs Act," there is one point to which I think the attention of analysts ought to be particularly called, with a view to obtaining its alteration in committee; since, if allowed to remain in its present form, it would be unjust towards the analysts (appointed under the old Acts), and also towards the authorities appointing them. I refer to these words occurring in Clause 12 "or if there be no such analyst then acting for the district, to the analyst of a neighbouring district." With the exception of these words, there is no objection to the clause, which runs thus: "Any purchaser of any article of food in any district, county, city, or borough, where there is an analyst appointed under this or any Act hereby repealed, shall be entitled on payment to the analyst, *or if there be no such analyst then acting for the district, to the analyst of a neighbouring district*, of a sum not more than ten shillings and sixpence, as shall be agreed upon between such person and the analyst, to have such article analysed by such analyst, and to receive from him a certificate of the result of his analysis."

An analyst being paid a salary by a certain county or borough, and in consideration of such payment agreeing to perform all analyses of food or drugs purchased in that county or borough, at a fee much below that usually charged, is it fair to the authority appointing the analyst that persons purchasing food in a county or borough, which contributes nothing towards his salary, should, nevertheless, be able to employ him at the reduced scale of charges applicable to his own district? or is it fair to the analyst himself that he should be required to make analyses for a district with which he has no connection on the same terms as for that from which he receives a salary? If such is to be the case, then those districts which do not think fit to appoint their own analysts will be able to get their work done at the expense of their neighbours who have already done so; and an analyst holding one appointment will be pretty much at the mercy of those counties or boroughs in his neighbourhood which do not choose to make appointments for themselves.

If the words are to remain in the clause, then every county and borough ought to be compelled to make its own appointment, and be allowed to call in the analyst of a neighbouring district only in cases of emergency.

Clause 22 is also objectionable. Surely an analyst should be at liberty to refuse, if he thinks fit, any analysis not coming from his own district; and when he does accept it, is it not quite unreasonable to expect him to do it at a maximum charge of ten shillings and sixpence?

The first object of an act for preventing adulteration should be to secure thoroughly competent and trustworthy analysts, not to obtain the greatest possible amount of work for the smallest possible amount of money, which seems to be the aim of the new act. The only result to which such an attempt can lead is gradually to fill up the appointments with inferior, if not altogether incompetent, men—to introduce slipshod, rough and ready (and consequently inaccurate) processes into the laboratories of public analysts, and to bring both the law and science into discredit and contempt.—I am, &c.,

AN ANALYST.

THE AMMONIA SODA PROCESS.

To the Editor of the Chemical News.

SIR,—Being desirous of adopting the ammonia process in the manufacture of soda, I take the liberty of asking you

if you would be kind enough to inform me in what publications (serial or otherwise) I could meet with a description of the process and of the necessary plant.—I am, &c.

HENRY CHARLES PLATTS.

Nevsky Prospect, No. 11, St. Petersburg.

NOTICES OF BOOKS.

A Manual of Hygiene, Public and Private. By C. A. CAMERON, Ph.D., M.D., &c. Dublin: Hodges, Foster, and Co. London: Baillière, Tindall, and Co.

DR. CAMERON has here presented us with a goodly volume, embracing nearly all subjects bearing upon public health. He treats of the duties of sanitary authorities and health officers; of nuisance; of vital statistics; of water supplies, the composition and examination of purification and softening of water; of bad water as a cause and carrier of disease; the quality of the water in Irish towns; on normal and abnormal air, &c. On all these subjects, his own extensive experience as a Public Analyst and Health Officer has been supplemented by abundant and judicious reading, and, as far as we are in a position to judge, the information which he gives is, as a rule correct.

As we have on various occasions attempted to do, he warns the public against supposing that further sanitary reforms are not required. After touching on the epidemics of the middle ages, he adds—"I wish to direct attention to these almost forgotten calamities, because they are calculated to teach us important lessons. Are we sure that we are safe from another visitation of the 'black death'? There are epidemiologists who believe that the germs of this disease still linger among the deep valleys of the Himalaya, and that they may yet be wafted to Europe. If such an event should ever unfortunately take place, I fear that in some of our towns the virus of the disease would find a genial soil."

We heartily concur with the view expressed in the following passage:—"The Medical Officer should never conduct a prosecution, nor appear in court in any other capacity than that of a skilled witness." This applies with equal force to Public Analysts, some of whom, as was pointed out at one of the meetings of their Society, have gone astray in assuming something too much resembling the duties of a prosecuting solicitor.

In case of exhalations from chemical works, the Health Officer is advised to "be slow to suggest a remedy." If it proves a failure, as may easily be the case with the suggestion of one not specially conversant with the process carried on, the magistrates will be little disposed to take his advice in future.

As regards the supply of water, Dr. Cameron speaks favourably of the Welsh lakes, which certain projectors view as an ultimate source whence London may be furnished. We fear, however, that all such waters, freely exposed to light and warmth, will, during the summer season, be found to contain organisms. Nor can we approve of Mr. Bailey Denton's plan of collecting the drainage from sub-soils at the depth of about 4 feet. Such water must be identical with that furnished by shallow wells, of which we have seen quite sufficient. As regards the analysis of potable waters, we find that, like all chemists who have taken up this subject in a really practical manner, he gives the decided preference to the process of Wanklyn, Chapman, and Smith. He cites a water from a public pump at Waterford containing, per gallon, 4.06 grains of free ammonia and 0.4 of organic nitrogen! This is equal to many kinds of sewage.

The question as to the comparative value of hard and soft waters for dietetic purposes is brought forward, but the evidence is too conflicting to allow of a decision. The high death rates of Manchester and Glasgow may be explained without the supposed injurious action of soft water.

In the section on the propagation of disease by means of water, the author states, on the authority of Dr. Ballot,

of Rotterdam, that in Holland, in places where rain-water was in general use, the disease was by far less violent. How does this agree with the few, that the poison of epidemics is conveyed in the atmosphere?

Under the head of nuisances arising from manufactures, we find, curiously enough, no mention of the sulphurous acid generated in the combustion of coal. The soap manufacture retains a bad name from old times, when the soap-boiler received crude fats mixed with impurities from the slaughter-house. But no factory can be freer from nuisance than a modern soapery, which consumes merely palm and olive oils, refined tallows, oleic acid, &c.

Amongst the disinfectants, we find no mention of "Cooper's salts"—a mixture of the chlorides of magnesium and calcium—certainly not the least efficacious.

In speaking of sewage processes, the author makes the bold statement that "the A B C system, which consisted of adding alum, blood, and clay (he should have added, and charcoal) to the sewage, has failed." That this process has failed in a sanitary point of view we most emphatically deny, and we regret that Dr. Cameron has not taken the trouble to examine this matter personally before coming to such a decision. If the A B C process has not yet proved commercially lucrative, it has but shared the common fate of all sewage processes, irrigation by no means excepted.

The unfortunate Select Parliamentary Committee on the Adulteration of Food, and its "Report," are dealt with in a very lenient manner, and their glaring sins are overlooked.

We might devote a much greater space to this volume, and might multiply interesting extracts almost indefinitely, but we prefer to refer sanitarians to the work itself. They will find it a useful, comprehensive, and generally trustworthy *vade-mecum*.

Jahresbericht über die Fortschritte auf dem Gebiete der Reinen Chemie. Von Dr. WILH. STAEDEL. Tübingen: Laupp.

THIS volume is the first issue of a valuable yearly periodical, giving a summary of progress in the department of pure chemistry. The work is divided into three sections, embracing respectively inorganic, organic, and theoretical and physical chemistry. The applications of chemistry to other sciences, or to practical purposes, are not included in the plan of the learned editor. Analytical methods and improvements have also been excluded, in view of the excellent and universally known quarterly publication of Dr. Fresenius. So far as we have been able to examine the volume before us, it gives a fair, clear, and tolerably full account of all researches and discoveries in pure chemistry, with references at the foot of the page to the original documents in the proceedings of learned societies, and in the scientific journals of the Continent, of Britain, and of America. We have no doubt that this annual will be extensively useful, and we wish the author the fullest success.

Preis-Courant der Fabric für Alcohol Präparate von C. A. F. KAHLBAUM, Berlin.

THE very existence of an establishment like that of Mr. Kahlbaum, devoted to the manufacture and sale of preparations of the alcohols and their derivatives is a proof of the wonderful development which chemistry has recently experienced. We find here a price list of upwards of 220 compounds belonging to the methylic, ethylic, propylic, butylic, and amylic series, besides others pertaining to the aromatic series, and the announcement that other substances of the same class may be had to order. Amongst the rare and curious preparations here quoted we may instance sulphurea, anhydrous methylamin, anhydrous trimethylamin, nitroethan ethylphosphiniodhydrate, with diethyl and triethylphosphin, isobutylsulphhydrate, resorcin, acetonitril, diethylamin, &c. To the experimental chemist it is a great and a novel advantage to be able to procure such substances.

SUPPLEMENT

TO

THE CHEMICAL NEWS.

VOL. XXX. No. 796.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 18th, 1875.

Professor ODLING, F.R.S., President, in the Chair.

THE names of the visitors having been announced, and the minutes of the previous meeting read and confirmed, the following names were read for the first time—Messrs. A. Taylor, M. G. Crossman, C. A. Heywood, S. A. Hill, E. L. Cleaver, R. E. Cumington, and C. O’Keeffe. For the third time—Messrs. Henry John Yeld, Henry Shephard, Joseph William Thomas, Arthur Madge, Walter Saise, James Sanders Merry, C. H. Aldred, William James Lancaster, Charles C. Connor, and John William Biggart, who were balotted for and duly elected.

THE PRESIDENT, in accordance with the bye-laws, then announced the proposed changes in the council and officers of the Society for the ensuing year, after which he called on Professor CLERK MAXWELL to deliver his lecture “*On the Dynamical Evidence of the Molecular Constitution of Bodies.*” The Lecturer began by defining an explanation, stating that they might be of various orders, but that, as yet, we have not a complete dynamical explanation of so-called chemical phenomena. In studying the constitution of bodies we deal with particles which we cannot observe, for whatever may be our ultimate conclusions as to molecules and atoms, we have experimental evidence that bodies may be divided into parts so small that we cannot perceive them. The next thing required is a dynamical method of studying a system consisting of an immense number of particles, and the application of this method to molecular studies. This special adaptation has been to a great extent the work of Professor Clausius, of Bonn, whose equation

$$pV = \frac{2}{3} T - \frac{2}{3} \Sigma \Sigma (\frac{1}{2} Rr) \quad (1)$$

has furnished us with a new dynamical idea. Here p is the pressure of a fluid, and V the volume of the vessel which contains it. Vp , in the case of gases, is nearly constant, as Boyle’s law tells us, and is the product of two quantities which can be directly measured. T is the kinetic energy of the system, and since the kinetic energy of a particle is half the product of its mass into the square of its velocity we may write the equation in the form

$$pV = \frac{1}{2} Mc^2 - \frac{2}{3} \Sigma \Sigma (\frac{1}{2} Rr) \quad (2)$$

where M is the mass and c the mean velocity. In the second term r is the distance between any two particles, and R the attraction between them. The quantity $\frac{1}{2} Rr$ is called by Clausius the “Virial” of the attraction, $\Sigma \Sigma$ being their sum. From this it follows that the pressure of a fluid must be due wholly, or in part, to the motion of its particles, and not to a repulsion between them, since in the latter case the repulsion would be inversely as the distance, a law which Newton has shown to be inadmissible in the case of molecular forces. If we suppose the particles not to act on each other at all, the equation will become

$$Vp = \frac{1}{2} Mc^2 \quad (3)$$

and as it may be proved that c^2 , the mean square of the velocity, depends only on the temperature, this equation

exactly represents Boyle’s law. Most ordinary gases however, deviate from this law, and this deviation may be accounted for by the action of the forces between the particles. In a rarefied gas the number of particles within a given distance of any one particle will be proportional to the density of the gas, or the whole virial will vary as the square of the density ρ^2 . Dividing (2) by V we get

$$p = \frac{1}{2} \rho c^2 - \frac{2}{3} A \rho^2 \quad (4)$$

where A depends on the temperature. Regnault has shown that as the density increases the pressure falls below that required by Boyle’s law. Hence the virial must be positive, and therefore the mutual action of the particles must be in the main attractive. On the other hand, when the pressure becomes still greater the substance at length reaches a state in which an enormous increase of pressure produces but a very small increase of density, indicating that the virial is now negative. The pressure at first depends almost entirely on the motion of the particles, and therefore varies nearly as the pressure, according to Boyle’s law. At length, however, the effect of repulsion will prevail over that of attraction, and the pressure will increase so that an exceedingly small increase of density will correspond to an enormous increase of pressure.

The author then discussed the results of Andrews’s researches on the pressure at various temperatures, pointing out the change in form of the curve, which corresponds to the “critical point” in the continuity of the liquid and gaseous states.

From the equation of Clausius it is easy to calculate the velocity of the particles, and this is found to be about 465 metres per second for oxygen, and 1859 for hydrogen. The reason why gases do not disseminate themselves through the atmosphere with velocities at all approaching those indicated, is that the molecule, after describing a very short path, encounters other molecules, and then describes a new path. Hence, it is evident that the rate of diffusion depends not on the velocity of the molecules, but on the distance they travel between each encounter.

The lecturer here explained the law of the distribution of velocity among molecules of the same kind as illustrated by a diagram he had prepared for this purpose, from which it appeared that if in the same vessel there are different kinds of molecules, some of greater mass than others, their velocities will be so distributed that the average kinetic energy of a molecule will be the same, whether its mass be great or small. Hence, if we have two gases in the same vessel, if the pressure and temperature be the same, the kinetic energy per unit of volume is the same, and also the average kinetic energy of a single molecule. There must, therefore, be the same number of molecules, in a unit of volume of the two gases, which is the law of equivalent volumes of Gay-Lussac and Avogadro. A molecule is defined as that small portion of the substance which moves as one lump during the motion of agitation. The density of a gaseous medium at standard temperature and pressure is proportional to the mass of one of its molecules as thus defined.

Hitherto, only the motion of the centre of mass of the molecule had been considered; the internal motions of the constituents of the molecule relative to the centre of mass, formed the greatest difficulty in the kinetic theory of gases.

It is not essential to the mathematical investigation to assume that the molecule is made up of atoms, but merely that the position and configuration of the molecule can be completely expressed by a certain number of variables, n , for instance. Of these, three are required to determine the position of the centre of mass, and the remaining $n-3$ determine its configuration relative to the centre of mass.

The kinetic energy of the molecule may be regarded as made up of two parts—that of the mass of the molecule supposed to be concentrated at its centre of mass, and that of the motions of the parts relative to the centre of mass.

The first part is called the energy of translation; the second, that of rotation and vibration. The sum of these is the whole energy of motion of the molecule; and, as the pressure of the gas depends on the energy of translation alone, so the specific heat depends on the whole energy.

Boltzmann has found that for n variables the average energy of translation is the same for molecules of all kinds at the same temperature, the whole energy of motion being to the energy of translation as n is to 3.

After considering the difficulties attendant upon the investigation of the relation between specific heat and the atomic constitution of the molecule, the lecturer said that the most important result of these enquiries was a more distinct conception of thermal phenomena. In the first place, the temperature of the medium is measured by the average kinetic energy of translation of a single molecule of the medium. In two media placed in thermal communication, the temperature, as thus measured, tends to become equal. In the next place, we learn how to distinguish this kind of motion, which we call heat, from other kinds of motion. Its peculiarity consists in being perfectly irregular; it differs, therefore, entirely from such physical phenomena as the transmission of sound, where the motion of the medium during the passage of the sound wave is regular.

The lecturer, in conclusion, by the application of the molecular theory to the luminiferous ether, showed that the latter could not consist of atoms or molecules.

The PRESIDENT said they would all appreciate the difficulty in which a chairman was placed when he had to remark upon a paper of this character; but there was one point which presented no difficulty, that of thanking Professor Clerk Maxwell, who had come amongst them to deliver this useful and interesting lecture. In common with every Fellow present, he could speak as to the instruction and gratification he had derived from the clearly-expressed explanation given of such recondite subjects; he might especially mention the variations from Boyle's law, and the illustration of the insensible transition of matter from one physical state to another. The cordial thanks of the Fellows were due to the Lecturer, and he thought that, to the list of great names connected with the dynamical theory, he might take the liberty of adding that of Clerk Maxwell.

The meeting was then adjourned until Thursday, 4th of March, when there will be papers "On the Chemical Constitution of the Brain, by Dr. Thudichum;" "On the Dissociation of Nitric Acid," by Messrs. P. Braham and J. W. Gatehouse; and "Researches on the Action of the Copper-Zinc Couple on Organic Bodies (No. VIII., on Chloroform, Bromoform, and Iodoform)," by Dr. J. H. Gladstone and Mr. A. Tribe.

The Faraday lecture, "On Liebig's Contributions to Experimental Chemistry," will be delivered by Dr. A. W. Hofmann, F.R.S., on Thursday, 18th March.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 4, January 25, 1875.

Effect Produced by the Application of Armatures to Magnets.—M. J. Jamin.—The author has already indicated (*Comptes Rendus*, lxxviii., p. 1331) the procedure which enables him to calculate the total magnetism of a magnet. He employs magnets, the thickness and width of which are equal respectively to 10 and 50 millimetres; their lengths vary. The armatures are of the same width and thickness; they are adjusted as accurately as possible,

and secured by pressure on the extremities of the magnet which they prolong. If a single armature is placed at the northern end of a magnet, it in no wise modifies the magnetic condition of the southern end, which remains bare. If the effect produced on the south side by the application of an armature is considered, it will be found that it takes magnetism which the steel loses, but that this new distribution is no wise modified by putting an armature on the opposite side, or by removing one. Hence, as regards armatures, there is an absolute independence between the two halves of the magnet. This independence proves a capital fact; that the application of an armature to one of the ends of the magnet occasions a new distribution there, but neither decreases nor augments the sum total of the magnetism there present: the steel loses what the armature gains. This points out a method of determining the magnetism of steel as compared with that of soft iron.

Mineral Substances Contained in the Juice of Beet-Root, and on the Potash Extracted.—E. Peligot.—It is well known that the beet, in addition to sugar, contains a great number of matters soluble in water. The author has made some new observations on the juice of this root as regards the mineral salts, which it contains to the extent of 6 to 12-thousandths of its weight. The ashes of the entire beet-root differ in composition from the ashes of the juice. Although the matter which forms the cellular part of the plant is not abundant, the pulp retains in the form of insoluble compounds almost the totality of the calcareous salts which are found in the ash of the root. The turbid juice, obtained by pressing the freshly rasped pulp of beet-root, contains a small quantity of these salts. It rapidly becomes coloured on exposure to the air, and cannot be filtered unless it has been previously boiled for a few moments. The heat renders insoluble all the phosphate and carbonate of lime previously held in solution by means of the carbonic acid, which all vegetable juices contain in abundance. Thus the juice of the beet-root, after ebullition, is free from calcareous salts. Nevertheless, in this state it still contains phosphates, as may be shown by the molybdic process. This phosphoric acid is chiefly found as tribasic phosphate of potash, of which the ash of the juice contains more than the third of its weight. A notable quantity is also present as ammonio-phosphate of magnesia. The ash of the juice contains 10 to 15 per cent of its weight of bibasic phosphate of magnesia. The defecation of beet-root juice is effected in all manufactories by adding to the heated liquid a certain dose of slaked lime. This is always followed by an escape of ammonia, due to the decomposition of the double salt of magnesia and ammonia. The magnesian salt, rendered insoluble by the neutralisation of all acids, forms part of the scum formed mainly by the phosphate of lime derived from the decomposition of the phosphate of potash. This scum is consequently a powerful manure. The carbonate of potash extracted from the residues of the sugar works contains a quantity of phosphate, which occasions at times inconvenience in the glass manufacture. The potash, as well as the sand and red-lead employed, should be as pure as possible. The presence of phosphate renders the glass milky and opalescent.

Researches on Albumenoid Matters.—M. P. Schützenberger.—Having observed a reaction in which albumen and its congeners are split up by mere hydration into products which are almost all crystallisable, and hence more easy to determine, the author concludes that a thorough examination of this reaction might throw a new light upon the proteic bodies. Coagulated albumen, heated with twice its weight of crystalline hydrate of baryta, and a sufficient quantity of water (1 litre per 100 grms. of dry albumen) begins to dissolve. When the temperature reaches the boiling-point, ammonia escapes, and carbonate of baryta is deposited. At the end of some hours the production of ammonia and carbonic acid slackens, and ceases almost entirely. At ordinary pressure, at 100°, the quantity of ammonia set at liberty, in 120 hours of

ebullition, has been found equal to 1.7 grm. per cent of dry albumen. The determination of the weight of carbonate of baryta led to this interesting result, that the ammonia and carbonic acid given off are exactly in the proportions required for urea. If the operation is carried on in an autoclave at 140° and 150° the reaction is more complete, the results being 4.1 ammonia per cent of dry albumen, and 24.0 carbonate of baryta, calculation requiring 23.7. The barytic precipitate contains a little oxalate and sulphite of baryta. From these observations it follows that the molecule of albumen contains the group of urea, and represents a complex ureide. It ought also to contain a group analogous to oxamid. A part of the sulphur of the albumen, that which alkalies do not immediately remove in the form of a sulphide, is contained in the state of a sulphurous derivative, reminding us of the taurine of the bile, which boiling alkalies split up into sulphate and acetate. The comparison is the more permissible, because very sensible quantities of acetic acid are found in the liquid. Returning to the liquid, freed by filtration from the deposit of barytic salts, and from free ammonia by prolonged ebullition, it was found of a yellowish colour. When freed from baryta by treatment first with carbonic, and then with sulphuric acid, and cooled, it yielded successive crops of crystals. The aqueous crystallisations were—Tyrosin, about 5 per cent; very little amido-œnanthyllic acid, amido-caproic acid, or leucin in notable quantity; amido-valeric acid, butalanine; amido-butyric acid. Albumen cannot in any case be the sole result of the union of leucin and its homologues. Along with these latter the author has isolated crystalline definite bodies, having less hydrogen.

Action of Electrolytic Oxygen upon Methylic Alcohol.—M. A. Renard.—The gas given off is small in amount, consisting of carbonic oxide, carbonic acid, and a small amount of a gas soluble in water, which appears to be oxide of methyl. On distilling the alcohol after its oxidation, and treating the distillate with chloride of calcium, a liquid is obtained, consisting of formiate of methyl, methylal and acetate of methyl. Methylic aldehyd is not formed.

Flame of Sulphur; and on Divers Lights useful in Photography.—A. Riche and C. Bardy.—The authors have re-examined the bisulphide of carbon and nitric oxide light of Delachanal and Mermet in the hope of finding means to obviate the danger of explosion, either by modifying the manner of operating, or by suppressing the use of sulphide of carbon, and of comparing the various flames which act upon the salts of silver. They recommend as the most efficacious, and as perfectly free from danger, the flame of sulphur burning in a jet of oxygen.

Determination of Atmospheric Ammonia.—Th. Schlœsing.—This paper is not intelligible without the accompanying illustration.

Presence of Copper in the Human Organism.—MM. Bergeron and L. L'Hôte.—The authors hold that copper, derived from various sources, is generally found in the kidneys and liver of human beings irrespective of age, sex, and condition of life. The examination of fourteen corpses and of six fœtus gave in every case affirmative results.

Electro-Chemical Resistance of Aluminium used as the Positive Electrode of a Voltameter.—M. E. Ducretet.—A voltameter with acidulated water received a slip of platinum and a slip of aluminium, placed in communication with the poles of a battery; if the aluminium is the negative electrode, hydrogen is disengaged upon it, and the current has its ordinary intensity. When the direction of the current is reversed, there is no longer decomposition of water, and the intensity of the current becomes very feeble. The surface of the aluminium does not seem affected; it is preserved by a thin layer of alumina. The author applies these results to the construction of a liquid rheotome, permitting the passage of the current only in one direction.

Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, No. 13, January, 1875.

Scum from Sugar Works, and the Danger of their Presence near the Manufactories.—M. Eug. Perrot.—The scum, after exposure to the air for some time, gives rise to an orange-red vegetation, which has been classed among the algæ. This plant is not merely the result of a phenomenon of fermentation, but is a true ferment, the origin of which coincides with a repulsive odour given off by the heap of refuse. This ferment acts upon saccharine juices in a very remarkable manner, the result being the transformation of the sugar into mannite. It acts merely upon alkaline liquids, a fact the more important, as this is the general case in the extraction of sugar from beet-root. If the juices are acid they resist the ferment. If the juice is taken as it leaves the bone-black filters, containing a mean alkalinity of two to three ten-thousandths of alkali, and if a few fragments of the ferment are added, the liquid exhibits all the signs of fermentation, which is complete in eight to ten days. The resulting matter, evaporated gently over sulphuric acid, then dissolved in alcohol, and evaporated anew, deposits crystals, which present all the physical and chemical characters of mannite.

Revue Universelle des Mines, de la Metallurgie, de, Travaux Publics, des Sciences et des Arts Appliqués à l'Industrie, November and December, 1874.

Reform of the Patent Laws.—Dr. Klostermann.—A powerful argument against the party who in the name of "free trade" seek to rob the inventor of his own exclusive creations.

American Legislation on Patents.—J. M. Thacher.

Statistical and Geographical Documents on Mining Industry.—1, Russia; 2, Portugal.

State of Mines in the Island of Sardinia.—M. Sella.—Conclusion.

Account of the Pernot Furnace.—M. Jules Petin.

Les Mondes, Revue Hebdomadaire des Sciences.
No. 2, January 14, 1875.

The Abbé Moigno states, on the authority of Dumas, that in consequence of the "materialistic discourses" of Prof. Tyndall, Dr. Du Bois-Reymond, &c., the politicians of Great Britain have been abruptly checked in their resolution to encourage more effectually higher education (!)

Nos. 3 and 4, January 21 and 28, 1875.

These numbers contain no chemical matter.

Reimann's Farber Zeitung, No. 1, 1875.

This number contains a receipt for a dark cinnamon and a dark reddish brown on wool; a black, violet, and brown on knitting-yarns; a light, medium, and dark olive on cotton yarn; a brown on silk; a bismarck, Russian green, brown, and dark olive (reseda) on leather; removal of the fatty gloss from woollen and mixed rags.

Aniline Black.—Hitherto it has been considered impossible to remove or discharge aniline black. G. Witz, however, has shown it to be possible. He treats the aniline black with an acidulated solution of permanganate of potash, when peroxide of manganese is deposited upon the fibre. This is then treated with a solution of oxalic acid, which removes the manganese, and leaves the tissue perfectly white. The solution of permanganate may be thickened with infusorial silica (kieselguhr), and printed upon the tissue, so that a white design can be produced upon an aniline black ground. The peroxide of manganese can also be produced by other methods, e.g., by successive treatment with salts of manganese and caustic soda.

Distinction Between Natural and Artificial Alizarin.—J. Weber proposes the following method to show

whether goods are printed red with extract of madder or with artificial alizarin. If the red in question is steeped in a solution of permanganate of potash, and then passed into an acid, the red produced with extract turns a reddish yellow, whilst that produced with artificial alizarin retains a decided rose colour. The two reds are still better distinguished by successive treatment with bichromate of potash and nitric acid. The red produced with extract is almost entirely discharged, whilst that from artificial alizarin retains a decided rose shade. If the tissue thus treated is boiled for two minutes in soda-lye at 18° B., washed and dipped in hydrochloric acid at 20° B., the red from artificial alizarin becomes light yellow, and that from extract a dirty orange. The experiments may be performed as follows:—The swatches are steeped for two minutes in a solution of 1 grm. permanganate in 200 c.c. of water, washed, plunged into hydrochloric acid at 3° B., washed, passed again into permanganate of potash, washed, and finally passed into solution of oxalic acid at 1° B. If chromate is preferred, the swatches are steeped two or three minutes in a solution of 10 grms. bichromate in 200 grms. water, drained, passed through nitric acid at 5° B., and washed.

Bulletin de la Societe Chimique de Paris,
No. 12, December 20, 1874.

Absorption of Gypsum by Bone-Black.—M. F. Anthon.—Bone-black is very difficult to wash to such an extent that the washings no longer precipitate chloride of barium. If over black thus washed there is filtered a saturated solution of sulphate of lime, it is found that the filtrate contains sulphate of ammonium. There is, therefore, a chemical reaction, and not a mere absorption in this case. Black which has absorbed gypsum yields it again to distilled water (*Dingler's Polytechnisches Journal*).

Use of Fluorides in the Manufacture of Glass.—MM. Hagemann and Jörgensen.—In America cryolite is used in making a white milky glass. The proportions are 9 parts of zinc white, 4 of cryolite, and 10 of quartz sand. The glass is very hard, brilliant, and not attacked by acids, even when powdered. This glass gives on analysis—

Oxide of zinc	.. .. .	6.50
Silicic acid	.. .. .	63.40
Alumina	.. .. .	3.67
Soda	.. .. .	5.85
Oxides of iron and manganese	.. .. .	4.40
Cryolite	.. .. .	15.14

99.96

In the manufacture of bottle-glass is used the fusible slag formed by the residues of cryolite melted with chalk for soda and alumina. This mass contains—

Chloride of calcium	.. .. .	62.01
Carbonate of lime	.. .. .	11.89
Lime	.. .. .	5.62
Carbonate of potash	.. .. .	0.37
Carbonate of soda	.. .. .	3.94
Magnesia	.. .. .	0.93
Silica	.. .. .	3.78
Oxide of iron	.. .. .	5.00
Alumina	.. .. .	5.00
Water	.. .. .	1.45

A bottle-glass, to which 9 per cent of this had been added, contained—

Potash	.. .. .	2.85
Soda	.. .. .	6.99
Lime	.. .. .	15.40
Magnesia	.. .. .	1.08
Alumina	.. .. .	11.00
Oxide of manganese	.. .. .	2.79
Oxide of iron	.. .. .	3.60
Fluorine	.. .. .	1.75
Silica	.. .. .	55.20

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in preserving blood for use as food. Edward Heinson Huch, Brunswick, Germany. May 15, 1874.—No. 1734. This Provisional Specification describes mixing lime with blood, and allowing it to settle, and then drawing off the clear liquid, and drying it with or without farinaceous matters.

Improvements in the manufacture and refining of sugar. John Henry Johnson, Lincoln's Inn Fields, Middlesex. (A communication from Henri Armand Joseph Manoury, Paris.) May 15, 1874.—No. 1736. This invention relates to the treatment of molasses, syrups, and other similar saccharine products obtained in the manufacture and refining of sugar; and consists in first adding to such molasses, syrups, or other similar saccharine products an alkaline carbonate, such, for example, as carbonate of soda or of carbonate of potash, for the purpose of rendering the organic and other compounds more soluble in dilute alcohol than they are when they exist in combination with lime.

Improvements in obtaining sulphate of soda or of potash, hydrochloric acid, and chlorine. Emil König and James Henderson, manufacturing chemists, Irvine, Ayr, North Britain. May 16, 1874.—No. 1742. This invention relates to improvements and modifications in processes of the kind described in the Specifications of Letters Patent, Nos. 853, 1305, of 1871; and No. 571 of 1872; granted to Emil König, one of the present applicants; and No. 1642 of 1871, granted to both the present applicants.

A new means to be employed for preserving every kind of animal and vegetable matter. Charles Adalbert Hermann Lindemann, M.D., of Manchester, Lancaster. May 18, 1874.—No. 1753. I claim the discovery of the antiseptic property of boric acid and its compounds, which are all powerful in protecting every kind of organic matter against decay, as well in the living as in the dead state. Consequently I make use thereof for the following purposes:—(1) Preserving fresh meat, blood, and its compounds, like albumen and fibrin; (2) embalming corpses; (3) protecting textile tissues against mildew; (4) curing and preventing contagious and miasmatic diseases.

Improvements in the preparation and application of certain materials for deodorising sewage, night-soil, and like matters, and in the manufacture of artificial manures. John Howard Kidd, Wrexham, Denbigh. May 19, 1874.—No. 1764. The invention consists in applying as a deodoriser carbonaceous or coal shales or coal washings, which materials are heated or carbonised in a suitable furnace, such as retort furnaces, and is then pulverised if desired. When thus prepared it is mixed with the sewage or night-soil, or other like matters requiring to be deodorised. In treating sewage, the solid matter is allowed to settle in tanks, then the surplus water is drained away, and salt or lime is added, and then sufficient mineral carbon or material obtained from carbonaceous shales or coal washings as above explained is added, and mixed with the sewer sediment to cause it to dry readily. The material thus obtained is further and greatly enriched as a fertiliser by the addition and mixture of bone-dust, nitrate of soda, sulphate of ammonia, and other like matters.

MEETINGS FOR THE WEEK.

SATURDAY, Feb. 27th.—Physical, 3. Mr. T. Wills, F.C.S., "On a Mode of Exhibiting to a Large Audience the Spectrum of Sodium." G. C. Foster, F.R.S., and O. J. Lodge, "On the Lines of Flow and Equipotential Lines in a Uniformly Conducting Sheet."

MONDAY, March 1st.—Medical, 8.
— London Institution, 5.
— Society of Arts, 8. (Cantor Lectures.) Rev. Arthur Rigg, M.A., "The Material, Construction, Form, and Principles of Tools and Contrivances used in Handicraft."

— Royal Institution, 2. General Monthly Meeting.
TUESDAY, 2nd.—Civil Engineers, 8.
— Zoological, 8.30.
— Royal Institution, 3. Alfred H. Garrod, Esq., "On Animal Locomotion."

WEDNESDAY, 3rd.—Microscopical, 8.
— Pharmaceutical, 8.
— Society of Arts, 8. Captain Bedford Pim's reply to the Discussion on his paper "On the Mercantile Marine of Great Britain."

THURSDAY, 4th.—Royal, 8.30.
— Royal Institution, 3. Professor Tyndall, "On Subjects Connected with Electricity."
— Royal Society Club, 6.30.
— London Institution, 7.
— Chemical, 8. P. Braham and J. W. Gatehouse, "On the Dissociation of Nitric Acid." O. Thudicum, "Chemical Constitution of the Brain." G. C. Kingzett, "Calcic Hypochlorite from Bleaching-Powder." W. N. Hartley, "On a Simple Method of Determining Iron."

FRIDAY, 5th.—Royal Institution, 8. Weekly Evening Meeting. Lord Rayleigh, "On the Dissipation of Energy," 9.
— Geologists' Association, 8.

SATURDAY, 6th.—Royal Institution, 3. Prof. W. K. Clifford, "On the General Features of the History of Science."

THE CHEMICAL NEWS.

VOL. XXXI. No. 797.

LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE
CHEMICAL SOCIETY.

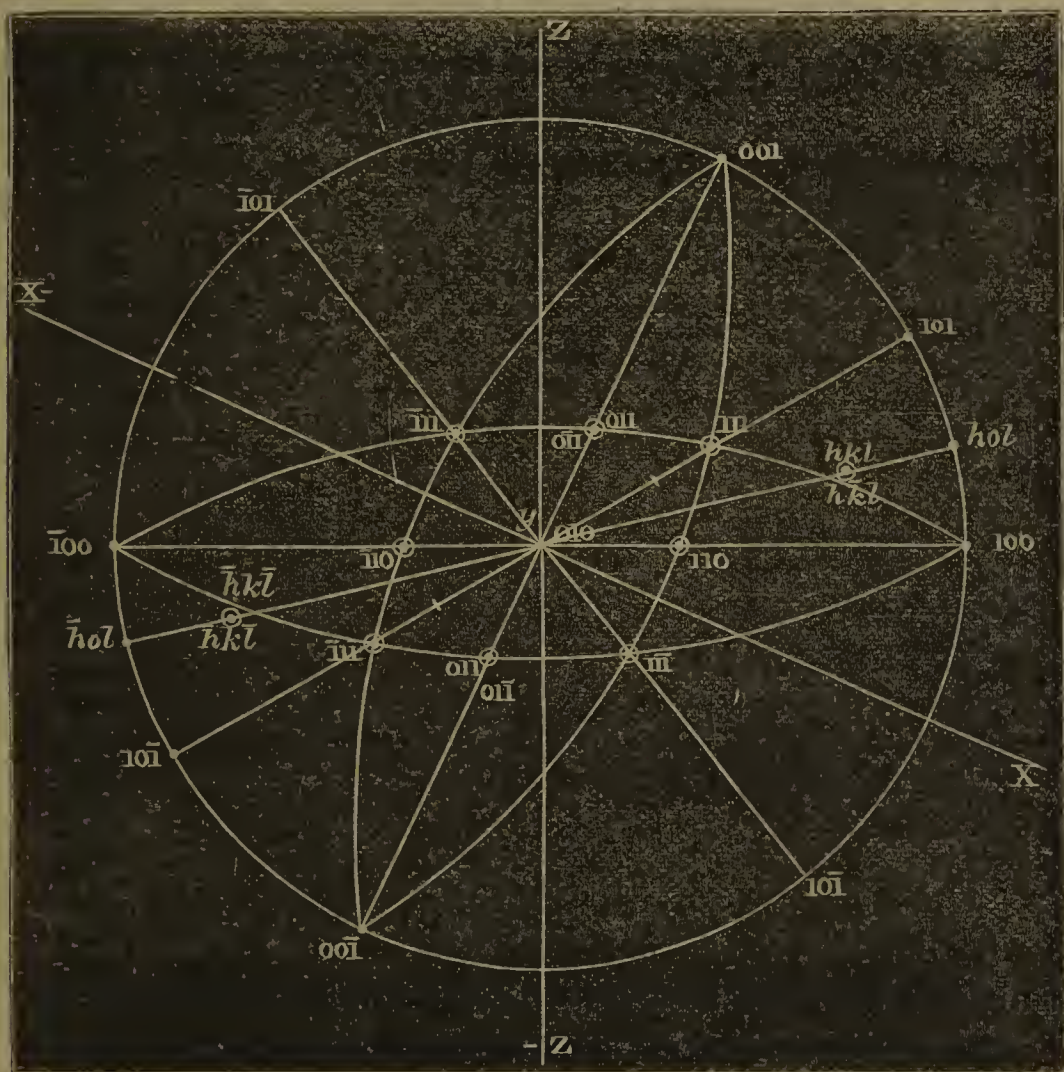
By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

(Continued from page 64).

LECTURE VIII.

IN resuming his lectures on crystallographic morphology after the Christmas vacation, Mr. Maskelyne took in hand to discuss the various crystallographic systems, as representing the kinds of symmetry possible in crystals.

FIG. 9.



The first of these systems to be considered was that which presented no plane of symmetry, symmetry to a centre being its only restriction in this regard. In this, the anorthic system, the faces will obey the zone laws already discussed; and, since the crystal is centro-symmetrical, each plane will be parallel to another plane belonging to its normal, and differing from it in symbol by the signs of the indices being opposite in character. These conditions involve no requirement not already recognised as resulting from the crystallographic law, and consequently all the five axial elements are free. The axial system may be expressed by the symbol—

$$\xi, \eta, \zeta; a:b:c.$$

Such an axial system may be yielded by any four planes of the crystal, though important ones are generally chosen, and a position can always be found such that the angles of the axes YZ and ZX are each greater than 90° in the positive octant, the angle of the XY axis being consequently either greater or less than 90° . The form in such a system as this will consist of but a pair of faces.

Next in order as we rise in the degree of symmetry presented by a crystal, we come to the clinorhombic system, the crystals belonging to which are symmetrical to a single plane, and at the same time to their centre. If we consider any of the zones on such a crystal to which the plane of symmetry belongs, it is not difficult to see that such a zone will be ortho-symmetrically divided by the plane of symmetry, and by a plane perpendicular to it. It will further be evident that all the faces of a form will belong to such a zone, and that they will therefore be four in number; the only exceptions will be those of the plane of symmetry itself and the faces perpendicular to it, for which cases the faces of a form are only two in number.

An axial system for a crystal of this kind is obtained by making the plane of symmetry one of the axial planes, namely, the plane ZX, and taking for the other two two of the planes perpendicular to the plane of symmetry. The positive angle ZX or η is taken greater than 90° .

It results, from what has been said of this system, that all the forms of it have the character of rhombic prisms, with the exception of the planes (hol) that occur only in pairs in the zone [100, 001], and of the pair of planes (010) (010) which are parallel to the plane of symmetry. The axial system under this type of symmetry will be represented by the expression—

$$\xi = \zeta = 90, \eta > 90; 1, \frac{b}{a}, \frac{c}{a},$$

where two of the five elements become fixed, in order that the crystal may fulfil the conditions entailed by one of its faces becoming a plane of symmetry.

The distribution of the poles of a form in the clinorhombic crystal is represented in the projection (Fig. 9): the eyelets representing the poles on the nether, the dots those on the upper hemisphere of projection. The poles of the forms (111), ($\bar{1}\bar{1}\bar{1}$), (hkl), (hol), (101), (110), and (011) are projected in the figure.

LECTURE IX.

BEFORE passing to the consideration of crystals symmetrical to more than one plane, Mr. Maskelyne took in hand the sort of distribution that the features of a crystal must present in a general case where there are two planes of symmetry. In such a case, viewing the poles of a crystal form as circumjacent to one plane of symmetry, it is plain that the presence of a second plane of symmetry will necessitate a distribution of the poles of a form, and of the other features of the crystal, in a symmetrical relation with regard to itself, and that at the same time each plane of symmetry and each mode of grouping of the features of the crystal will be repeated over the other plane of symmetry.

Planes of symmetry being thus mutually repetitive will form a zone of planes of one of the kinds already considered, where three or more of the angles included by consecutive tautozonal planes are equal, and it has been seen that such angles can only have the crystallometric values $90^\circ, 45^\circ, 60^\circ, 30^\circ$. Therefore, for a crystal to be symmetrical to two or to more planes lying in the same zone, these planes of symmetry can only have mutual inclinations that are crystallometric, and of such there can, therefore, only be four kinds. The first of these to be considered will be that where the two planes intersect at a right angle; and we may approach this case from another point of view.

Thus, if we suppose two of the poles lying on the great circle of symmetry in a clinorhombic crystal to occur at a quadrant's distance from each other, the two planes corresponding to these poles become potentially planes of symmetry, inasmuch as they satisfy the necessary conditions

for being symmetrical, and are inclined to each other at 90° ; and it is evident that, if any one of the planes of the system perpendicular to the first plane of symmetry is a plane of symmetry to the system, then also must a plane perpendicular to both these planes be potentially a plane of symmetry. Whence we pass at once, from the case of a crystal symmetrical to a single plane of symmetry, to a case in which the crystal is symmetrical to three of its planes which are perpendicular to each other; that it shall be so therefore involves only one condition beyond those that have to be fulfilled in the clinorhombic system.

Indicating the three perpendicular planes of symmetry by the letters S, Σ , and C, which we shall call the proto-, the deuto-, and the trito-systematic planes, we may proceed to discuss the character of a form belonging to such a system.

Taking these three systematic planes for axial planes, the zone axis of each pair (which is also the normal to the third plane) becomes a crystallographic axis, while the axial octants are commensurate with those formed by the three planes. Each octant will thus contain one pole of a form hkl , so that such a general form will present eight faces; and these faces will be scalene triangles.

The distribution of the poles of a form (hkl), and of the forms (100), (010), (001), and (111), as also of the two-

plane S and Σ at the crystallometric angle 45° , an angle therefore, compatible with their being planes of symmetry.

In observing, of the parameters in the orthorhombic system which we have just considered, that any one of the parametral ratios can represent equality at only one temperature, it becomes necessary to consider for a moment what is the effect of change of temperature in altering the morphological character of a crystal. Thus, with increase of temperature the crystal expands, but in the same degree only along directions that are morphologically similar; and, as a consequence of this, the angular inclinations of the faces of a crystal will also change.

Now, since the symbol for a plane involves two sets of ratios, those, namely, of the parameters of the crystal and those of the indices of the planes, but as, moreover, a symbol for a zone is directly deducible from the indices of its planes, it is clear that, if those indices have to be changed to represent the result of a change of temperature, the character of the zones, and so of the symmetry of the crystal, would undergo change. This, however, cannot be, for the indices, being rational numbers, can only change *per saltum*, whereas the expansions or contractions, and the angular changes accompanying them, are continuous. Consequently it is the parameters, and not the indices, that

change, and the zones, and with them the symmetry of the crystal, retain permanently their original characters in regard to symmetry; and it will further follow that the angles at which planes of symmetry are inclined to one another are permanent at all temperatures.

The next point on which Professor Maskelyne dwelt, before considering in detail crystals of a more complex symmetry, was the character of the spherical triangles formed by the intersections of the great circles lying in the planes of symmetry. Since, where two planes of symmetry exist in a crystal, the plane of their zone circle fulfils the conditions for being potentially a plane of symmetry, these three planes of symmetry will intersect with the surface of the sphere in three great circles to the triangle formed to which Mr. Maskelyne gave the name of the *systematic triangle*. Each crystallographic system, where there is more than one plane of symmetry, will thus be characterised by a systematic triangle of its own, and the sphere will become partitioned into a series of such spherical triangles resulting from their mutual repetition, alternate triangles being directly congruent, whereas adjacent triangles are not so.

The systematic triangle of the orthorhombic system will thus have its sides quadrants and its angles right angles, and would be represented by the expression—

$$S = \Sigma = C = \frac{\pi}{2} \\ s = \sigma = c = 90^\circ.$$

faces forms (100), (010), (001), is exhibited in the projection in Fig. 10.

The axial system will be represented by the expression—

$$\xi = \eta = \zeta = 90^\circ \quad \frac{a}{b}, 1, \frac{c}{b},$$

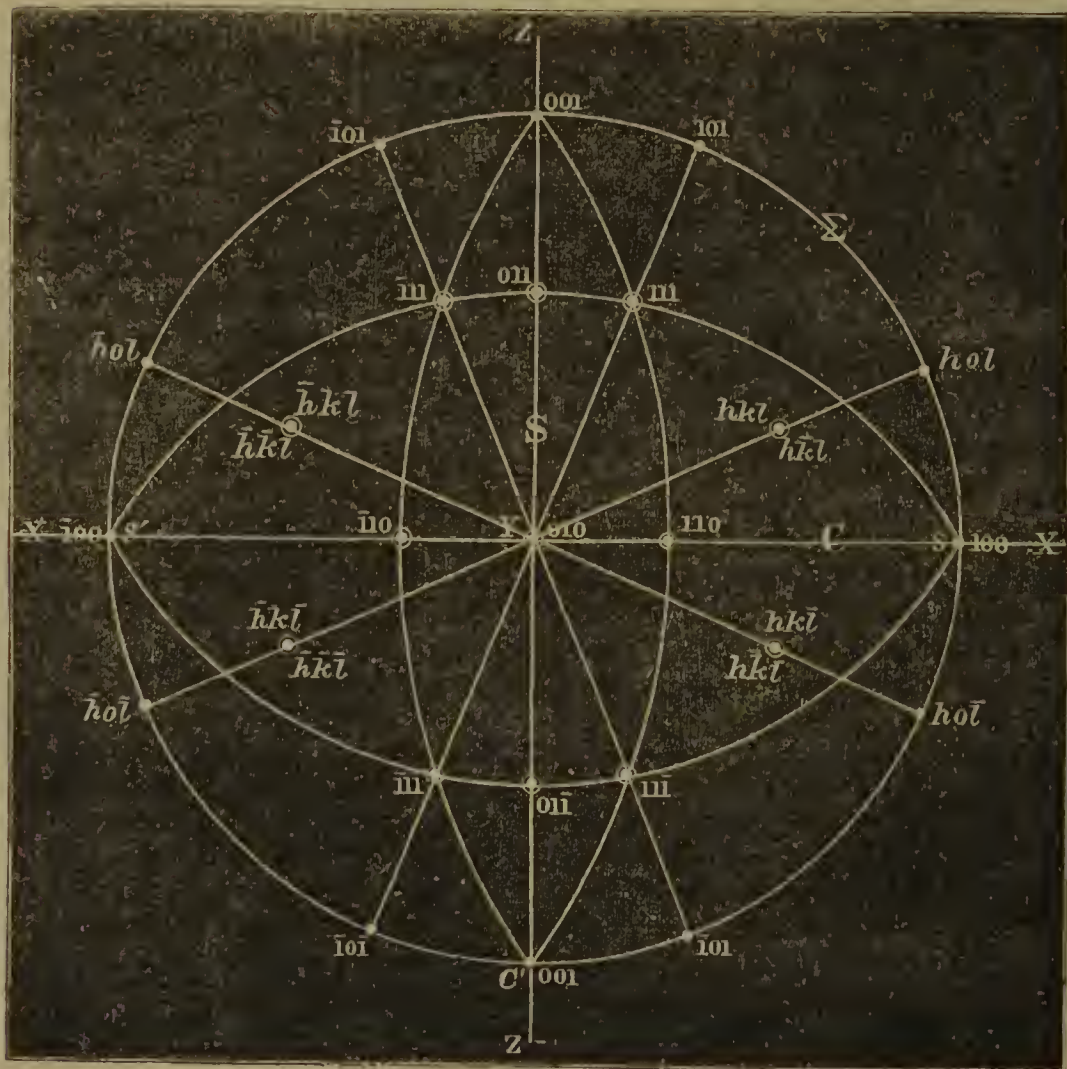
the two elements involved in the three parameters being unfettered. That these three parameters must all have different values, or at least values that can only be transiently equal at some special temperature, is seen in this: that, supposing a pole to be at a point bisecting one of the quadrants between the axes on, for instance, a great circle, C, a similar pole must occur on that great circle at a quadrant's distance from the assumed pole, and the faces to which these poles belong will satisfy the conditions of planes of symmetry, and will be inclined on the

The different letters which correspond to the different planes of symmetry indicating that these planes of symmetry are not *conformable* with its other; that is to say, that the features of the crystal are distributed in a different manner in respect to them severally.

The small letters indicate the angles, while the large ones represent the signs of the systematic triangle. It is evident that we may have various kinds of crystalline forms belonging to each crystal; varying, that is to say, according as their poles are situated either within a systematic triangle, or upon one or other of its three sides, or, finally, at the points at which those sides meet, namely, in the angles of the triangle and the symmetry presented by each such form will be of a different kind.

In the orthorhombic system, the general form, hkl , representing the scalene octahedron, has its poles within

FIG. 10.



the triangles, and the symbol only varies in the signs, not in the relative order of its indices. The rhombic prism $h k o$ has its poles on the sides C.

The protodome $\{o k l\}$ has its poles on the arcs, S, of the systematic triangle, and its zone-axis coincides with the normal of the proto-systematic plane, the axis X.

The deutero-dome $\{h o l\}$ has its poles on the arcs Σ , and its zone-axis, to which the edges are parallel, is the axis Y.

(To be continued).

SECOND NOTE ON SULPHOVINIC ACID.

By Dr. T. L. PHIPSON.

ACCORDING to the promise contained in my first note (CHEMICAL NEWS, vol. xxx., p. 221), the mixture of sulphuric acid and alcohol was submitted to the heat of a water-bath for three entire days, at the end of which time it was cooled, dropped very slowly into twenty times its bulk of cold water, and carefully saturated with carbonate of lime. The result was no better than with the acid prepared in the course of a few hours, and the quantity of sulphate of lime formed quite as great as before. It is, therefore, not possible to obtain a larger amount of product by this prolonged action of a temperature calculated to drive off the water separated from the alcohol.

The difficulty of obtaining pure sulphovinic acid, the great tendency of this acid and its salts to decompose and form bisulphates with production of alcohol, will, in all probability, preclude for ever their use in pharmacy. The sulphovinates of lime, potash, and baryta that I prepared many months ago in crystals, have hitherto kept without decomposition in simply corked bottles, but it is very doubtful that they would keep long in solution.

ON THE MANUFACTURE OF CAUSTIC SODA.*

By JOHN MORRISON, F.C.S.

(Continued from page 88.)

I HAVE not very much to say about the black-ash or ball furnaces proper; for, excepting that they are larger, and that their sides, instead of being metal plated, are simply secured by a number of horizontal strips of flat iron (say, $4\frac{1}{2}$ inches \times $\frac{1}{2}$ inch), they are pretty similar to those used on the Tyne. The fire-places are, however, peculiar. The fuel is supplied, not at the side, but at the end just under the arch, an open space (extending the full length of the furnace) being left for the purpose. The arch is not dome-shaped, but—highest at the fire end—is regularly depressed towards the other. Across the fire end of the furnace is a metal plate 2 feet in depth, cased up with 9-inch brickwork, and having a number of perforations 3 inches in diameter, corresponding with a similar number of pigeon-holes left in the casing. These holes are for the admission of air to the burning fuel. The perforated plate rests on the outer edge of an ordinary dead plate, under which are the fire-bars as usual. The fire-place is the full width of the furnace-bed, but to prevent waste of coal in clinkering (by facilitating the "damping" of the fire), a 9-inch mid-wall is run up the centre of the grate, terminating about 9 inches above the bars. The whole arrangement is simply a modified "cave" fire-place. The perforations raise the area of the most intense combustion to nearly, or even a little over, the top of the bridge, and cause a sharp, steady, and very effective flame. Were the perforations closed, the men would be unable to get their work

out properly, as, though there might be plenty of draught, there would, as they express it, be no "cut;" and then there is the other advantage of diminished wear and tear of fire-bars, which are kept much cooler than they could possibly be were all the air admitted between them.

Perhaps I had better not omit to add that "air courses" are the exception rather than the rule in Lancashire furnaces, and that a well-built 18-inch bridge lasts six months or longer, if care be taken that the fire-bars do not come below the level of the working "bed;" and I may as well also add that "beds" are very rarely taken out, the usual plan being, about once a month, to put on a patch of broken bricks and sand, fluxed in with a little salt-cake, the business, which does not necessitate the stoppage of the furnace, being done by the men themselves, in the interval between their shifts.

The tanks or vats, with their settlers, are, excepting in their slightly modified fittings, almost identical with those in use here, so that I may without delay proceed to describe the specialities of the caustic plant proper.

There are three stages in this manufacture—causticising (including filtration of mud), concentrating, and finishing.

The causticiser, or operation pan, may be of any convenient shape, but is usually a vessel 26 feet by 6 feet, and 6 feet 6 inches deep, the bottom being circled. It is provided with an agitator (driven by a small bracket engine bolted to the end of the pan), one or more steam-pipes for heating the charge, a sludge-valve for running off the mud, and, if necessary, a drop syphon for removing the clear liquor.

Sometimes, when economy in plant is an object, mechanical agitation is dispensed with, and the cheaper arrangement of injections or "blowers" substituted. These, by forcing through the liquor a mixture of air and steam, serve the double purpose of agitating and heating, and, in addition, assist in the oxidation of the sulphides.

The filter is usually of wrought-iron. Frequently an old boiler, cut in halves longitudinally, serves the purpose. But, if specially made, it is generally about 20 feet by 10 feet, and four feet deep. On the bottom are placed, in an open manner, bricks on edge, say, about 2 inches apart, but along the centre a clear channel is reserved, which in its turn is loosely covered with bricks or slabs; on the top of this arrangement is a layer of coke or limestone (preferably the former) 8 or 9 inches in depth, then a second layer of smaller pieces, and third still smaller, lastly a covering of clean coarse sand or small coal, on which cast- or wrought-iron grids are laid to afford a convenient shovelling bottom. A barrow or two of clean riddled cinders from one of the furnaces, or a similar quantity of small coal scattered over the grids, then renders the filter—in which there still remains 18 to 24 inches in depth of clear space available for lime mud ready for use; but communicating with the sough or channel just described, in the bottom of the filter, is a 2 or 3-inch pipe, connected with a small boiler or air-tight tank of, say, 150 or 200 cubic feet capacity, erected preferably above the level of the operation pan, and which is in its turn in connection with a vacuum pump. The top of this boiler is provided with an air-cock, and to the bottom a run-off tap is attached; the former for the admission of air, when the liquor is being removed by means of the latter. And when a water-gauge has been affixed to the end of the boiler, the filtering apparatus may be said to be thoroughly equipped. The second stage includes the evaporation of the liquors.

Attached to each black-ash furnace, in place of the ordinary salting down or black salt pan, are two cast-iron boat-pans, placed end to end, to form a prolonged continuation of the furnace. The term "boat," it is perhaps scarcely necessary to say, only applies to the dished sides, for the ends are quite upright, and the form of the top being rectangular, with slightly rounded corners. The usual dimensions of these pans are 12 feet by 8 feet, measured on the top, with a depth of 3 feet along the central or deepest portion. The pan furthest from the furnace is placed about 6 inches higher than its neighbour, and the

* A Paper read before the Newcastle-upon-Tyne, Chemical Society.

bottom of the latter corresponds in height with the soffit of the black-ash furnace arch. One continuous 14-inch mid-wall, on which the bottom of the pans rest, sustains the major portion of the weight of the latter, while a front and back 14-inch wall (which are simply extensions of the furnace sides), built up to the flanged tops, firmly supports or stays their two sides. In other words, the pans are sustained by three parallel longitudinal brick walls, and across the two flues or passages which the latter form, are built up to within 8 inches of the pan sides, and carrying their sweep three or four fire bridges, for the purpose of keeping the flame well up to the metal, and the hollow spaces intervening between the bridges are filled up to within a foot or so of the pan with brickbats or clinkers, with a similar object. The flame, on emerging from the black-ash furnace, passes over these bridges, traversing the full length of the two pans, previously to passing into the drop at the far end of the back one, which is in communication with the main flue. Those just described are termed the "weak" pans, but to them the "strong" pans are precisely similar, excepting that, instead of being subjected to the action of "waste" heat merely, they are self-fired. There are two arched fire-places attached to the front, or working pan, of each pair, built side by side against its outer end. They are each about 4 feet 6 inches by 2 feet 3 inches, one being opposite each flue; that is to say, one is built on each side the central supporting wall, which extends outwards for the purpose. The products of combustion from each fire pass along their own side, till, on arriving at the end of the back pan, they unite and pass down one common drop in connection with the chimney.

The pots in which the third stage is completed are constructed to hold 10 tons of finished caustic soda, being 9 feet in diameter and 5 feet 6 inches in depth. They are set in innumerable ways (every manager having his own pet fashion), with the common object of dividing the heat, so that the "boil" may take place equally all round; for if the flame impinge too much on one side, that portion will wear out very rapidly. The great aim, in short, is to prevent the pots becoming thin and wearing into holes at one particular spot. They do not, however, usually die of genuine old age, but become useless most frequently by leakage caused by the formation of a hole or open crack generally one or two feet from the bottom. Neither is the wear of a smooth character, but chiefly exhibits itself in blotches, or pock-marks of greater or less depth, and from $\frac{1}{4}$ to $\frac{1}{2}$ an inch in diameter. The side of the pot against which the fire is built is almost invariably protected from the direct action of the flame by means of a guard or shield of brickwork, against which the flame splits into two portions, which between them encircle the pot before uniting again to pass into the flue. Generally the pots rest on a metal plate, and are stayed in an upright position with brickwork; but the chief support is secured by the circular curtain wall—forming the side flues—into which three lugs cast equidistantly round the pot, about a foot from the top, project. The metal plate just alluded to facilitates the occasional turning of the pot, which is advisable to prevent localisation of the wear.

In the best constructed caustic soda works the pots are all within range of an overhead traveller, which very much simplifies any alteration or removal. Without this appendage, the business is a comparatively troublesome one, for the pots, weighing about $6\frac{1}{2}$ tons, are rather awkwardly shaped for convenient handling, and any pleasure there might otherwise be in the job is seriously marred if, as is usual, a neighbouring pot is in process of being nitred, for at such times the work of turning or removal is particularly disagreeable; and if the results are less to be feared, the temporary sensations are quite as decided as the process of stinging by an indefinite number of pretty lively wasps.

Occasionally, caustic pots are heated by gas generated in an ordinary producer, but experience has shown this method to be anything but economical in fuel.

(To be continued.)

SOCIETY OF PUBLIC ANALYSTS.

"SALE OF FOOD AND DRUGS ACT, 1875."

SINCE we had occasion to refer to this embryo Bill last week, it has been interesting to notice with what a chorus of disapprobation it has been received by the press, and how the fatal objections, which we were the first to point out, have been generally appreciated and endorsed.

The *Times*, in a leading article on the 1st inst., commented upon a letter which the Secretaries of this Society had felt it their duty to address to that Journal, and said—"All persons, and especially all poor and comparatively illiterate persons, should have reasonable security for obtaining the chief necessities of life in a state of such purity that they may really possess the nutritive or other properties with which they are credited by the purchasers."

In reference to the exception under Section 6, which renders the "usage of trade" an excuse for adulteration, and to which exception we have already most emphatically objected, the *Times* says—"It would be a prodigious gain if the influence of law could bring the adulteration of necessities to be regarded no longer as an 'usage of trade,' but as a disgraceful offence; and there can be little doubt that such a change in the commercial way of looking at things would speedily tend to diminish adulteration generally."

In meeting another objectionable point in the Bill, the *Times* well remarks—"If the vendor pleaded mere ignorance, his plea ought not to save him; and if he pleaded that he had himself been deceived by the person from whom he purchased, his remedy should be in bringing that person before the Court, and having him punished. . . . The moderate penalty, however, which would destroy the dishonest profit of the retail adulterator would be a comparatively small tax on the dishonest profit of the wholesale dealer, and to meet this difficulty it might be provided that the amount of the fines should bear some proportion to the quantity of adulterated goods which had been sold." In concluding this article, the same Journal observes—"The Secretaries of the Society of Public Analysts assure us that the business of food analysis is daily becoming better understood; but, notwithstanding this, it would be judicious that the number of analysts should, at first, be somewhat limited, and that their remuneration should be such as to place them in a position of independence."

The *Lancet* has published an able and exhaustive article echoing and amplifying our objections to the Act. We have not space for any quotations, but we will give the closing one, which involves the conclusion of the whole matter:—"One would think that it (the Bill) had been drawn up by a conclave of adulterating manufacturers, who, while professing the desire to afford the public some protection against adulteration, yet contrived that the measure should cover nearly every form and species of adulteration which the ingenuity of man has hitherto succeeded in devising."

In reference to the exception which we took to the definition of the word "food," in Section 3 of the new Bill, we have recently had occasion to peruse "An Act to impose License Duties on Compounders of Spirit, &c.; and to prevent the Adulteration of Food, Drink, and Drugs," passed by the Parliament of the Dominion of Canada, in May last year. From this Act we quote the definition of the words *food* and *drink*, and we think that, for clearness and comprehensiveness, the Imperial might well take a lesson from the Colonial Legislature:—

Food "means and includes every article used as food in the state in which it is offered for sale, or that is used in the preparation of food by admixture therewith either before, during, or after cooking."

Drink "means and includes any liquid used as a beverage, and any article used in or for the preparation or partial preparation of any beverage."

FORM OF CERTIFICATE.

To * and
To all to whom it may concern.
I, the undersigned, Public Analyst for the
do hereby certify that I received on the day of
, 18 , from†
a sample of for analysis, which then
weighed , and have analysed the same,
and declare the result of my analysis to be as follows:—
The said sample contained the parts as under.

Observations.‡

I return the residue of the sample not consumed in the analysis herewith.

As witness my hand this day of
18 .
A. B.,
at .

* Here insert the name of the person submitting the article for analysis.

† Here insert the name of the person delivering the sample.

‡ Here the analyst may insert, at his discretion, his opinion as to whether the mixture (if any) was for the purpose of rendering the article portable or palatable, or of preserving it, or of improving the appearance, or was unavoidable, and may state whether in excess of what is ordinary, or otherwise, and whether the ingredients or materials mixed are or are not injurious to health.

We will now endeavour, very briefly, to draw attention to one or two flaws in the new Act, which have, we think, up to now either partially or wholly escaped notice:—

The first "exception," under Section 6, would—under pretence of rendering an article "portable, or of preserving it,"—admit of the addition of sulphuric acid to vinegar, and of salt to milk.

The second "exception" would—under pretence of rendering an article "palatable, or of improving its appearance"—allow of the adulteration of coffee with chicory, bread with alum, mustard with flour, &c.

Section 8, which may be described as the "labelling one, might well be incorporated with Section 6 as an "exception," and it is indispensable that the word "legibly" should be inserted in the proper place, as we have heard of labels where the type was so exceedingly ornamental and minute as to convey no real warning of the "mixture" to the purchaser unprovided with a magnifying glass.

Section 7 provides for the punishment of a person selling an adulterated article "if the matter mixed be more than is ordinarily required." Will the promoters of the Bill kindly inform us of any fixed standard of the quantity of an adulterant "ordinarily required"?

In Section 19, which refers to the Analysts' Quarterly Reports, it would be convenient to add a clause permitting the addition of any remarks—in reference to any of the samples analysed—which the Analyst might consider it desirable to make.

In Section 25 we have already pointed out that—while the retailer could not be punished if he could produce a "warranty" from the wholesale dealer—no provision is made for the punishment of the wholesale dealer if such a "warranty" is found to be false; but besides this, it is clear that if—with any modifications—this "warranty" business is to be persevered in, some specific form of "warranty" should be prescribed by the Act, and some means provided for verifying the connection between a given warranty and a given sample.

The Bill contains, as a Schedule, a proposed form of certificate, which document we reproduce above, with the single remark that as a specimen of involved and impracticable absurdity it really is ingenious.

A less ambitious and very much simpler form of certificate will be submitted to the Local Government Board, and, if approved, we may print it next week.

The Bill was committed *pro forma* last evening, with a view to its being reprinted with, of course, the alterations the Government are prepared to accept, but what shape it may bear when next we have to speak of it it would be hazardous to predict. We trust, however, that if it be not entirely re-cast,—which would be, perhaps, the best plan,—at any rate the obnoxious clauses to which such general attention has been called will be expunged. It is, in any case, satisfactory to know that—before it becomes Law, it must pass the ordeal of that Upper Chamber where "trade" interests are less likely to be considered than the good of the community at large.

ON THE
POISONOUS INGREDIENTS AND MIXTURE
CLAUSES OF THE
"SALE OF FOOD AND DRUGS ACT."

Two objects are aimed at in the Adulteration Acts,—viz., the prohibition of poisoning, and the prohibition of selling articles of food or drink under wrong names.

In order to prohibit poisoning the old Adulteration Acts, as well as the Bill designed to supersede them, enact that the admixture of anything poisonous with an article of food shall entail heavy penalties. Now, on examination, it appears that this phraseology is not happy, and, instead of the offence being the admixture of a poisonous material with an article of food, it ought to be defined to be *the rendering an article of food poisonous*. The two things are by no means identical, as a few examples will make manifest. Thus, although the substance which imparts the almond flavour is poisonous *per se*, and although the confectioner who flavours articles of food with the almond flavour becomes liable to the penalty of £50 under the Act, yet it would be most monstrous to fine him, since articles of food are not necessarily rendered poisonous by almond flavouring.

Sulphuric acid *per se* is highly poisonous, and yet vinegar with a little sulphuric acid in it is not poisonous at all. The essential oil of mustard *per se* is poisonous, and yet a minute quantity of it in food is not poisonous but wholesome. A proportion of sulphate of copper which would be poisonous or harmful in bread (which is eaten largely), would not necessarily be poisonous in pickles which are eaten but sparingly; and in short it is unavoidably, right or proper, in many instances, to "knowingly mix an article of food with ingredients of a nature injurious to health," and the legislature would only stultify itself if it were to enact the contrary.

In the Bill at present before Parliament, it will be observed that not only is the mixing of articles of food with poisonous or harmful ingredients prohibited, but the prohibition extends to drugs; and here the consideration will present itself that, since many drugs are poisonous, there would be difficulties in the way of an enactment against the rendering drugs poisonous; and much might be said in favour of excluding drugs altogether from the operation of the New Adulteration Act, and of dealing with them separately in a special Act of Parliament.

Touching the second object of the Acts on Adulteration, viz., the prohibition of the sale of articles of food under wrong designations, it may, perhaps, be useful to show that nothing more than that is really contemplated in those parts of the Bill relating to non-poisonous admixtures. This will indeed be plain from Section 8, which permits a vendor to vend any admixture of articles of food with any non-poisonous substances whatsoever, and in any proportions, provided only that what is done be fairly indicated by the label accompanying the articles. It is not in contemplation to stop the sale of skimmed milk, but to prevent skimmed milk being sold as unskimmed milk. It is not meant to prohibit the sale of mixtures of coffee with chicory, but to prevent such mixtures being sold as pure coffee. Neither would it be wise to prevent the baker from making bread of such flour as requires a trace of alum to render it available for that purpose,

provided only that he would offer it for sale as alumed, if, having made that confession, he could find customers for it.

If, then, the Bill only contemplates putting a stop to deception, the question will naturally arise as to the possibility of much simpler provisions than those at present standing in the Bill. Why should not the section run, "No person shall sell any article of food under a designation which does not fairly indicate what it is."

It is true that such an enactment would throw upon those who have to work the Act the burden of defining what is meant by certain names, and what is a fair description; but this burden they have already, and must continue to bear under any conceivable Adulteration Act.

ORDINARY MEETING,

February 5th, 1875.

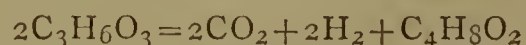
Dr. REDWOOD in the Chair.

THE third paper read was by THOMAS STEVENSON, M.D.:—

THE DECOMPOSITIONS OF MILK, WITH ESPECIAL REFERENCE TO ITS ANALYSIS WHEN IN A DECOMPOSED STATE.

The analysis of milk which has been kept until natural decomposition has set in, or in some cases advanced to a considerable extent, is an operation which the analyst is occasionally called upon to perform. He may also be required to state the extent to which a second analysis of a milk made at a date remote from the day on which the milk was drawn from the cow, may be expected to differ from an analysis made whilst the secretion was still fresh and undecomposed, and how far a second analysis is vitiated by the changes which milk is liable to undergo when kept. It is also important to be able to obviate, if possible, the difficulties entailed in the analysis of milk by the natural changes which the fluid undergoes when kept. Prior to experience it might, perhaps, be expected that when a milk has become decomposed, its analysis, so as to obtain a satisfactory result, is no longer possible. This, however, is not necessarily the case. At all events such an analysis may very frequently be made, as will enable the analyst to state whether a milk is skimmed or watered, and to ascertain within narrow limits the original composition of the milk, though minute accuracy is seldom possible in a second analysis made when milk is decomposed. In order to be able to overcome the difficulties of the analytical problem to which I have referred, it is requisite that the analyst should be familiar with the changes which milk undergoes when kept. For our purpose we may regard milk as an aqueous solution of milk-sugar, casein, and other albumenoids and mineral matters, holding in suspension butter-fat. The more minute constituents of milk, such as urea, are present in too small quantities to influence materially the results of analysis. The first and most obvious change which milk undergoes is, that it undergoes the lactic fermentation, its milk-sugar becoming converted into lactic acid. This change is not accompanied by any sensible alteration in weight; the elementary constituents of the milk-sugar re-arrange themselves in the same proportions to form lactic acid. No perceptible amount of gas is evolved during the lactic fermentation. The lactic acid formed exercises, however, a very important influence upon the casein, depriving this of alkali, and rendering it insoluble. Probably, also, changes are simultaneously wrought in the arrangement of the mineral constituents of the milk, though, as to these, our knowledge is very imperfect. Although the lactic fermentation is usually stated to be very simple, the change of milk sugars into lactic acid is never in reality so simple; for in all cases there appears to be the formation of a small quantity of ethylic alcohol. Should a milk have simply undergone the lactic fermentation, the analysis of the sample in its

decomposed state will, I find, present the following anomalies: (1.) The amount of cream by volume cannot be ascertained. (2.) The specific gravity of the sample will not accord with the original specific gravity of the sample; not only may the change brought about in the casein by acidification alter the density of the fluid, but also the solution of lactic acid produced will have a density different from that of a solution of milk-sugar. (3.) The total solids per cent will not be materially influenced by the lactic fermentation. It is true that the solids yielded by drying a soured milk are usually a little less than those found in the same milk when fresh, but the difference will not be great. The loss is due first to the evaporation of a trace of alcohol; but, secondly, and chiefly, to the decomposition which occurs on drying a sour milk at 100° C., as is shown by the dark brown colour of the dried milk-solids. Concentrated lactic acid chars organic bodies at a temperature of 100° C. (4.) The ash will be a little lower than that of the fresh milk, and the chlorides will be diminished. It is impossible to evaporate, dry, and incinerate a mixed solution of lactic acid and an alkaline chloride without loss of hydrochloric acid. Indeed, it is well known that to obtain all the chlorine in milk it is necessary to ignite with an excess of a base, such as baryta. (5.) If the fat be estimated by exhaustion with ether, the percentage of fat will be too high, since some lactic acid will be dissolved by the ether. Only a portion of the lactic acid formed in the milk will pass into the ethereal solution; some of it will remain combined with the inorganic bases of the milk. Nevertheless, those difficulties may be overcome, provided that the decomposition of the milk has not advanced beyond the stage of lactic fermentation, and that no gas has been evolved. The acidity of the milk may be determined by titration, and the requisite proportion of soda added to a weighed quantity of the sample, which is then analysed in the ordinary manner. Or, a weighed quantity of freshly ignited sodium carbonate is added to a weighed portion of the sample, so that the milk is rendered just neutral to litmus-paper, and the analysis is then conducted as usual. In calculating the results the necessary corrections must be made; first, for the loss of hydrogen on neutralising the acid ($C_3H_6O_3 + NaHO = C_3H_5NaO_3 + H_2O$; or $2C_3H_6O_3 + Na_2CO_3 = 2C_3H_5NaO_3 + H_2O + CO_2$); and, secondly, for the sodium carbonate introduced into the milk-ash. The results by either method are excellent, and there is no solution of lactic acid in ether. Milk, when kept for long periods, especially in partially filled vessels, does not stop at the formation of lactic acid; but the lactic is apt to undergo an irregular butyric fermentation, with the consequent formation of butyric acid. Now this kind of fermentation is accompanied by the evolution of a mixture of hydrogen and carbonic dioxide gases; and the theoretical loss during the conversion of lactic into butyric acid amounts to rather more than one-half of the weight of the lactic acid. But the butyric fermentation is also accompanied by the formation of a small quantity of butylic alcohol, and probably of other bodies also. Hence the equation for the butyric fermentation—



is not strictly accurate. Probably the casein and butter-fat are simultaneously altered. The milk acquires a cheesy odour. In consequence of the acid state of the fluid, the fermentation is irregular. A milk which has undergone butyric fermentation is hence almost beyond the reach of an analysis directed to ascertain its original composition. Had we any means of distinguishing between the butyric acid formed by the fermentation of lactic acid, and the butyric acid liberated by separation from the glyceride of butyric acid, the problem might, perhaps, be simplified. I have found the analysis of milk, kept so as to have a butyric or cheesy odour, to yield most discrepant results, especially in the amount of solids not fat; and no reliance can be placed upon the analytical figures, except those relating to the ash. Nevertheless

considerable light may be thrown upon the genuineness of even a putrid milk by a determination of the amount of ash, and of the chlorine present in this. Two precautions are, however, necessary—to determine the ash of a sufficiently large quantity of the milk (20 c.c. at least), and to determine the chlorine in a separate portion of ash from a portion of the milk evaporated with a slight excess of sodium carbonate, in order to avoid loss of chlorine. An analyst, then, may generally with safety undertake the analysis of a milk which has simply undergone the lactic fermentation; but when the sample has advanced a stage further, and the butyric or cheesy odour is perceptible, no certain and reliable results are attainable, and a probable opinion only can be given as to the genuineness of the article, based upon the determination of the ash and the chlorine in the ash. In connection with this I may direct attention to the recent researches of G. Bunge (*Zeitschr. f. Biologie*, B.J. x., p. 295), on the variations in the quantities of the alkaline chlorides in milk. It is usually assumed that the chlorine in cow's milk is very constant, and forms one-tenth of the ash, *i.e.*, is about 0.07 per cent of the whole milk. There is, however, always a slight loss of chlorine during the incineration of a milk residue, except a little alkali be added before evaporation. This loss is usually, with careful incineration, 6 or 7 per cent of the total chlorine. Bunge shows that the chlorine in milk ash is far from constant. He found, in fact, the chlorine to vary from 0.098 to 0.211 grm. in 100 c.c. of cow's milk. In fact, the quantity of chlorine in milk may vary so much as 100 per cent, according to the manner of common salt taken in the food. Too much importance, therefore, ought not to be attached to the presence of an excess of chlorine in milk ash, so long as the chlorine does not form more than about 0.2 per cent of the whole milk.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

THE first Annual Report of the President, Prof. Gladstone, F.R.S., and Council, shows that the formation of the Society has been in every way attended with very gratifying results.

The meetings were commenced under singularly favourable circumstances, as the Lords of the Committee of Council on Education generously placed the Physical Laboratories and Lecture Rooms at the disposal of the Society.

It may be mentioned that the success of the Society is due in no small measure to the care and energy of Dr. Guthrie, Professor of Physics at the Royal School of Mines.

The first paper was on the "*New Contact Theory of the Galvanic Cell*," by J. A. FLEMING, B.Sc., and many valuable communications have been read during the year.

The Society has already lost a very able member by the death of Dr. W. S. Davis, of Derby, at the early age of thirty-two years:—

The following is the list of Officers and Council for the present year:—

President—Prof. J. H. Gladstone, F.R.S.

Vice-Presidents—Prof. W. G. Adams, F.R.S.; Prof. G. C. Foster, F.R.S.

Secretaries—Prof. A. W. Reinold, M.A.; W. Chandler Roberts.

Treasurer—Dr. E. Atkinson.

Demonstrator—Dr. F. Guthrie, F.R.S.

Other Members of Council—Latimer Clark, C.E.; W. Crookes, F.R.S.; Prof. A. Dupré; Prof. O. Henrici, F.R.S.; W. Huggins, F.R.S.; Prof. H. M'Leod; W. Spottiswoode, F.R.S.; Dr. H. Sprengel; Dr. W. Stone; E. O. W. Whitehouse.

CORRESPONDENCE.

DOUBTFUL MINERALS.

To the Editor of the Chemical News.

SIR,—Please to afford me space for a few last words on Doubtful Minerals and Double Nomenclature, inasmuch as Professors Maskelyne, How, and Burghardt have honoured me by some pertinent and valuable remarks on my previous communications.

I very much regret that my letters have laid me open to the suspicion of a desire to mark with a slur the fair names of Dana and Maskelyne. I had so such thought; for, most certainly, the learned professors who bear these distinguished names cannot, in any sense, be classed with the "doubtful."

These talented presidents of the Republic of Minerals hold important positions of pretty equal elevation; but, betwixt them there is a great gulf fixed, and there is no Colossus of Rhodes to bestride it. Each has been exercising the questioned right of private judgment, and using spectacles tinted to suit his own particular sight. Some disciples, out of compliment to both, have been borrowing a lens from each, and whilst thus clouding their vision have sighed through divided affection, "How happy could I be with either, were t'other dear charmer away." &c.

These potentates, uninterrupted, for some time have been involved in an amiable war of words; and, although just now, it happens, they only shot their guns with persistent "yea" and "nay," the pellets, nevertheless, cause a good deal of fluttering in the flock of very small birds who peck at the food in the great men's hands. Fortunately, anywhere, "cats may look at kings."

Dana and Maskelyne, by English students, are looked up to as Mineral sponsors and authorised Registrars. But, the students say, our masters are so much at variance; they have a habit of calling names across the Atlantic, which may be equal to the same thing, but are not equal to one another. This habit bothers them a good deal, because they say the names themselves are not even echoes of each other to help the identity of things signified. For example, chalcopryite is authoritatively flashed by cablegram from Yale College, and *presto*, it is changed into copper pyrites at the British Museum! Dana, all the while sheltering himself under the popular notion that "The Greek language is the most approved source of names." Be it so. Therefore χαλκος, the Greek for Brass, is made an equivalent of yellow or copper, or of both together. Surely it is a small matter that Henckel, in his *Pyritology* (1725), wrote of *chalcopryites*, "it is a very good distinctive name for the ore." It happens that it was called kupferkies at least 150 years earlier than that date; so then, by virtue of Dana's new law, the German word ought to claim priority of choice, always assuming some advantage in the resuscitation of either. I half blush to write it, but *yellow copper ore* is a distinctive expression wherever English is spoken, and those who like it will continue to use it whilst the ore is of any value in the mineral market. To my weak mind, chalcopryite no more explains copper pyrites than the *Meus porcus et ego* of my boyhood explained mahogany.

There never will come a time, perhaps, when all minerals will be called by appropriately suggestive names: that is no reason, however, why we should not presently try to exterminate the hoard of *aliases* that now beset us. These aliases are enormous nuisances, and in being their open enemy (it is not to serve any selfish motive), I do but contend, in the interests of common humanity, for something like uniformity of nomenclature. Any radical changes of name ought to be made, I think, more in conformity with what's what than with who's who. Maskelyne's alteration of Smithsonite to hemimorphite, to wit.

Not having any pet names of my own to substitute, I

could contentedly take the catalogues of Maskelyne and Dana, and as to the discrepancies draw lots for the preference, and thus clear the fencing at a bound. The *pedigree* of minerals might be left at the Herald's College, or better it may be at the British Museum, alongside the Assyrian tablets, containing the legend of the building of the Tower of Babel. Let us, if we can, have one name for one thing, and stick to it. In fact, minerals might be easier recollected *numerally* than by the present absurd and unscientific practice of bandying personal baptismal compliments, &c.

The great burden of the mineral student's song is the obligation to do *double duty*, in the way of recollection. To some this is found almost impossible; to many it is most irksome, and to all it is a tax upon life-time, more iniquitous by half than the income tax. Besides, there is neither useful knowledge nor recreation to be got out of such continuous fagging. I don't at all object to being called *tar* on this side the salt ocean, but I strongly object to being called *pitch* on the other. Any sensitive substance would, because there is no advantage in the duality to anybody, and one might be mistaken for the other in transit. This dual-miasma has given me a kind of intermittent fever, worse than is caught in the Campagna; and, when the fit is on, I seek relief in my antiseptic initials. I sometimes find it, and am now hopefully looking forward to the time when I may put myself into the attitude of the tail-piece of Bristow's Glossary, for the correspondence so far has resulted favourably in the reduction of the "Doubtful Minerals," and I dare say this dual business will be cleared up some day; and now a parting word to my kind observers.

Professor Maskelyne in his letter gratifies me immensely. He unhesitatingly declines "to defend a cause which is essentially a bad one." His declaration is at once manly and judicious. He writes, "Responsible, not only to Englishmen, but to the whole world, for whom this collection is becoming a sort of metropolitan collection, I have shrunk from the extensive changes in the nomenclature that the adoption of Dana's names would involve." May he long enjoy the same temperature.

I cannot anywhere have even hinted that mineralogists are likely to be misled by Maskelyne's nomenclature, for I think just the contrary. But, when Dana's standard, and by far the completest work on mineralogy in the English, and, perhaps, in any other language, differs so very widely from the British Museum catalogue, the fact is by no means insignificant or unimportant, especially as we have no British book corresponding with Dana's for authoritative guidance.

If I were Chancellor of the Imperial Exchequer, I should have an exceedingly strong desire to double the remuneration of all the courteous officials in the public Natural History Departments, and should, most certainly, propose a special grant of at least £5000 a year, for the publication, periodically, of all the new and interesting facts in relation to natural history that might be acquired by them in the interim. This done, light would not remain hid under a bushel as now—talent would actually escape from its folded napkins, and the world would get a thick "quarterly" of estimable interest and value, in lieu of the scrubby catalogues and papers that are only occasionally afforded to the enquiring multitudes of whom I am an obscure unit. It may not be any part of the ordinary duty of the present courteous officials to write memoirs or amplified descriptive catalogues; but it might be, to the advantage of everybody, as your own pages show, in the abstracts of recent lectures of the highest possible order on the "Morphology of Crystals."

That matchless accumulation of minerals, empty shells, and stuffed skins at the British Museum always appears to me to be making signs for music of some kind, either that it may be less monotonous as a dumb show (as at an exhibition of waxwork), or for spirit-stirring human tongues to tell out its latent excellencies, not exclusively

to select and learned societies, but to the unlearned and gaping crowds—the children of all ages, rank, and condition—who come at leisure to look at the "pretty things." With plenty of food in the store, the hunger and thirst after knowledge might be easily appeased.

To Professor How I owe an apology for an offence against his good taste; and I will confess that when I wrote the first letter I was not at all intent on turning delicate periods, and certainly not on annoying him or anybody else. I do not, however, altogether regret having written it, for the world now knows by this time, through your Journal, that How's "Cyanolite" is fully described in the *Edinburgh New Philosophical Journal*, 1859, and that he is himself in possession of the veritable mineral. Dana (1868) refers to *Edin. New Phil. Journ.*, x., 84, 1859 (341 B) for How's Cyanolite. Inadvertently, I mistook this contracted reference for some American Journal out of my reach, and I merely noted Dana's remark that cyanolite "is probably the same mineral with centrallassite, impure with much more silica or chalcedony, impure with centrallassite." Dana (1874) makes no further allusion to it: hence its place in my list of "Doubtful Minerals." It is now said by Dr. Burghardt to be "simply okenite." How he arrives at this conclusion he does not say. Without in the slightest degree doubting the accuracy of How's analyses, I wish somebody would just steam to the Black Rock of the Bay of Fundy, and send a lump of the mineral to the British Museum, that the facts of this triple alliance of cerinite, cyanolite, and centrallassite may be definitely settled. Still, after the Professor's expostulation, we cannot find it in our stoney heart to hang the pet he hugs so tenderly.

My neighbour Dr. Burghardt hopes that my "mind will at last be set at rest." He is not alone in that hope. To a great extent I have got over the "confusion of tongues." He says, in his last letter, "He might have saved himself all this trouble by studying *German* books on the subject." Not so, however, for I have tried it. He says also that, "In mineralogy we are immeasurably behind Germany." Not exactly the fact either. English mineralogists, for the most part, are familiar with German scientific literature. It is not long in finding its way to England, where English professors read it in due course, and profit accordingly. What becomes of all the new mineralogical facts is quite a different question. They sometimes appear in the *Family Herald*, of all odd places, amongst the conundrums! "*Dawsonite*" popped up the other day in *Public Opinion*! What and where next? Perhaps, in the end public opinion may be brought to bear on the question, and names of minerals may become household words. All natural history facts ought, it seems to me, to find a central station, and not merely a resting-place, at the British Museum; and should be thence disseminated somehow (I would almost say anyhow) officially. I do not indeed "forget that there are other languages besides English." I am aware that Germans are not all dull, and that Englishmen are not all brilliant. I am aware also that the English language is not necessarily inexpressive, and that it is gradually and rapidly becoming universal. I know, therefore, of no reason why an English scientific book should necessarily compare unfavourably with one in any other language. Thackeray used to say, to the effect, that books which are written compare unfavourably with the books which might be written. Many persons now think so. Frankly, I much prefer the German mineral nomenclature to the mongrel Greek and personality that has been foisted on us, although, at the same, I should not always like to go the length of Nickelthoneisenzinksilicat, notwithstanding its analytical expressiveness.

Indeed, I have not been the author of any "of the confusion in the names of minerals." My small efforts have been quite in the other direction.

I follow Maskelyne and Dana as far as they go, and anybody else who goes further. What more can I do? My great difficulty is in properly treating what may be

called the *Mineralogical Orphans*, fallen out of the ranks from unknown causes or weakness of constitution. Some of their parents and sponsors have been dead a very long while, and nobody appears to know where many of them came from. I don't care to keep an asylum for them any longer, but wish them to die a natural death, and to be sanitarily buried, or cremated (if preferred) clean out of sight and out of mind.

Dr. Burghardt has contributed several items to the credit of this account and the common good, and for one I thank him. By the way, I didn't say that stilbite was an antimony mineral. I did know better than that, and stillolite I called an outcast. Dr. B. says, "As to stillolite, no such name is known to modern mineralogists." Just so; but it used to be the name of a variety of siliceous sinter. Thomson (1854) mentioned it as "allied to opal." Dana (1874) puts "stillolite v. opal" in the "Index Expurgatorius." The poor thing therefore, having now no friends, peradventure we may safely make an end of it here.

I feel rewarded in having drawn attention to this important subject in the proper quarters, and I believe the *desideratum* to be not very far distant. My next communication shall be as concise as this has been verbose.

T. A. R.

Feb. 15, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin,
No. 15, November 9, 1874.

Siljeström's Experiments for Determining the Changes of Density of Diluted Gases.—D. Mendelejeff.—A mathematical paper; not adapted for abstraction.

Remarks on the Influence of the Alkaloids upon Certain Properties of Hæmoglobin.—E. Schaer.—The author calls in question certain views put forward in Rossbach's *Pharmakologischen Untersuchungen*, that is, that the transference of ozone by means of hæmoglobin is checked by quinine; and, further, that both the oxidation of the blood by means of atmospheric oxygen, and the formation and separation of carbonic acid, are checked by many alkaloids. The author considers that all conclusions as to the suspension of the transference of ozone by means of the action of alkaloids should be regarded with extraordinary caution; and that a rational interpretation of the influence of quinine as regards the thermometric decrease of the processes of organisation in the organism, must be attempted from other points of view.

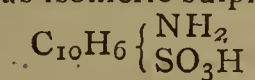
Communications from the Griefswald Laboratory.—H. Limpricht.—These communications relate to a new method of preparing the amido-sulph-acids; a further examination of compounds derived from ortho-amido-para-sulpho-toluic acid, by M. Hayduck (*Berichte*, p. 552); and a paper on the "position" of the nitro group in the nitro compounds of ortho- and para-brom toluol.

Isomeric Nitro-Toluylic Acids, Azo-Toluylic Acids, and a Second Cymol Sulph-Acid.—F. Fittica.—This paper consists of hypothetical speculations.

Oxidation Products of Isobutylic Alcohol.—Ernst Schmidt.—A confirmation of the view of Kraemer that acetone is found among the normal products of the oxidation of isobutylic alcohol.

On Chrysen.—Ernst Schmidt.—The author has not succeeded in detecting chrysen among the condensation products of benzol, as maintained by Berthelot (*Bull. Soc. Chim.*, vi., p. 276).

Sulph-Acids of Naphthylamin.—Ernst Schmidt and Beruh. Schaal.—The authors have attempted the preparation of the various isomeric sulph-acids of the formula



and the comparison of their properties and products of decomposition.

Di-Iso-Propyl-Keton and Methyl-Iso-Propyl-Keton.—R. Münde.—The former of these compounds is sparingly soluble in water, but readily and in all proportions in alcohol and ether. Acid alkaline sulphites do not combine with it. It reduces ammoniacal solutions of silver. Its oxidation produces isobutyric, acetic, and carbonic acids. Nascent hydrogen transforms di-iso-propyl-keton into a secondary alcohol of the group of the heptyl compounds, and at the same time into oily products, boiling at high temperatures. Methyl-iso-propyl-keton is a clear liquid of pleasant odour, boiling at 93° to 94°, and having the sp. gr. 0.811 at 15° C. With bisulphite of soda it forms a crystalline compound, but has no action upon ammoniacal solutions of silver. Oxidising agents resolve it into acetic and carbonic acids, and water.

On Ortho-Dinitro-Benzol.—A. Rinne and T. Zincke. The authors have succeeded in obtaining a third dinitro-benzol belonging to the ortho series (*Berichte*, vii., p. 869). It fuses at 117° to 118°; sublimes at higher temperatures in fine fern-like leaflets. In hot alcohol it dissolves readily, more easily than the para, but less easily than the meta compound. It is slightly soluble in hot water, in which the para compound is almost insoluble. From its solutions in alcohol, benzol, and chloroform it may be obtained in fine tabular crystals of the rhombic or monoclinar system.

Levulic Acid formed during the Action of Sulphuric Acid upon Sugar.—A. von Grote and B. Tollens.—The new acid is most easily obtained from the levulose produced by the inversion of cane-sugar. It crystallises in fine leaflets, is capable of distillation, and the most of its salts are crystalline. Its composition is $C_5H_8O_3$. The authors have examined the zinc, lime, potash, and silver salts.

Presence of Allylic Alcohol among the Products of the Dry Distillation of Wood.—B. Aronheim.—The author demonstrates the presence of allylic alcohol in ordinary wood-spirit.

Cyan-Acetic Acid.—J. van't Hoff.—Already noticed.

Action of Ammonia on Acetone.—N. Sokoloff and P. Latschinoff.—At common temperatures acetone absorbs 8.5 per cent of its weight of ammoniacal gas. Städeler's acetone-ammonia is not formed. Acetone purified according to the method of Saint Gilles is not resolved into aldehyde and methylamin. If aldehyde saturated with ammonia is allowed to stand at an ordinary temperature for three to four weeks, and is then mixed with the quantity of pulverised ammonia necessary to form an acid salt, a crystalline precipitate is at once formed, which, on treatment with boiling alcohol (of 95°), is resolved into insoluble oxalate of ammonia, and a soluble salt of the base $C_6H_{13}NO$. This base Heintz named diacetamin, but the authors consider it should be called diacetonyhydrin.

Certain Compounds of the Sulphide of Mercury.—Karl Heumann.—The white body mentioned in the author's paper (*Berichte*, vii., p. 752) is identical with the white precipitate obtained by passing a small quantity of sulphuretted hydrogen into the solution of mercuric nitrate. Palm and Barfoed have made known a series of analogous compounds, combinations of mercuric sulphide with various salts of the same metal. The blackening of these precipitates by alkalis depends on the separation of mercuric sulphide. Palm asserts the existence of analogous red-addition products, formed by cinnabar with the salts of mercury. Barfoed disputes this view, having obtained with cinnabar the same white compound as with the black amorphous sulphide. The author's experiments confirm those of Barfoed.

Action of Chloride of Copper upon Sulphide of Mercury.—Karl Heumann.—The author obtained a compound of these bodies in the form of a brilliant orange powder, containing—

Mercury.. .. .	60.44
Copper	19.16
Sulphur.. .. .	9.67
Chlorine	10.72

99.99

Communications from the Greifswald Laboratory.—H. Limpricht.—Ortho-toluydin sulph-acid was converted into the diazo compound, and this again into bromsulpho-toluolic acid, the salts of which are here examined.

Connection of Substituted Benzols and Phenols.—F. Beilstein and A. Kurbatow.—On comparing the physical properties of the three isomeric series it is found that the para compounds are mostly solid, have the highest melting- and boiling-points, and are the most permanent. The ortho derivatives are generally liquid, and have the lowest melting- and boiling-points. The meta bodies hold an intermediate place.

Derivatives of Methyl-Diphenylamin.—R. Gnehm.—The author has come upon substances very closely connected, and possibly identical with the dipara-pikrylamin and barium dipara-pikryldiamin of Austen.

Diffusion of Gases through Soap-Bubbles.—F. C. G. Müller. A preliminary communication. The author describes an experiment proving that gases may be diffused through thin layers of liquids.

Answer to Struve's Reclamation.—M. Traube.—A controversial paper relative to the behaviour of alcoholic yeast in media free from oxygen gas (See *Berichte*, vii., p. 872).

Action of Oxide of Silver on Bichlorpropionic Ether obtained from Pyruvic Acid.—E. Klimenko.—A preliminary announcement.

Reply.—C. Liebermann.—A comment on Schmidt's reply to the charge that his treatise on anthracen and chrysen is substantially a repetition of the author's researches on chrysen.

Compounds of Mono-Chlor-Aldehyd with Aromatic Hydrocarbons.—E. Hepp.—This paper, which is not adapted for abstraction, is a continuation of the Strassburg researches on the synthetic preparation of the aromatic compounds.

Alcoholic Fermentation.—F. Mohr.—A refutation of the views of Brefeld.

Worm-Seed Oil and Cymen.—A. Faust and J. Homeyer.—The authors consider the identity of cymen and cymol no longer doubtful.

Eucalyptus Oil.—A. Faust and J. Homeyer.—The authors examine two bodies found in eucalyptus oil, $C_{10}H_{16}$ and $C_{10}H_{14}O$.

Condensation of Higher Ketons.—O. Jacobson.—Not adapted for abstraction.

Changes of Position in the Aromatic Series.—E. Demole.—An examination of iodosalicylic acids; the action of melting potash upon pure di-iodosalicylic acid; and action of heat upon pure oxysalicylic acid.

Liebig's Annalen der Chemie und Pharmacie.
Heft 1 and 2, 1874.

Communications from the Laboratory of Professor Wislicenus, at Wurzburg.—These consists of a paper on the constitution of phosphorous acid, ethylester, and of phosphorous acid, by Dr. Carl Zimmerman; remarks on the conversion of substituted thio-uric matters into guanidins, by Dr. Carl Foster; and a memoir on the action of ethyilden-oxychloride upon zinc-ethyl, by Dr. Fried. Kessel.

On Gentisin (Gentianin).—H. Hlasiwetz and J. Hubermann.—This body was discovered by Henry and

Caventon in the root of *Gentiana lutea*, where it is present in small quantity. On ultimate analysis, the authors found that it contained—Carbon, 64.85; and hydrogen, 4 per cent; results which agree very closely with those formerly obtained by Baumert, and are compatible with his formula, $C_{14}H_{10}O_5$. They succeeded in producing a gentisic acid, which fuses at 197°, and crystallises without water. Its analysis leads to the formula $C_7H_6O_4$, identical with those of protocatechuic acid, dioxybenzoic acid, oxysalicylic acid, and hypogallic acid; with none of which, however, it is identical, as the authors show by a comparative table of its reactions.

Researches on the Biliary Colouring Matters.—R. Maly.—(See *Annalen*, 163, p. 77.) An examination of bilirubin and biliverdin. The author points out the presence of the former pigment in the gall-stones of oxen.

Communications from the Laboratory of Professor V. Meyer, in Zurich.—These consist of a memoir on the nitro compounds of the fatty series, by V. Meyer; a note on the history of hydroxylamin, by the same chemist; a paper on primary iso-nitro-butan, by E. Demole; and contributions to the knowledge of the azo compounds, by W. Michler.

Nature and Composition of Tannic Acid.—Hugo Schiff.—An examination of the tannates, especially those of ammonia, potash, soda, baryta, antimony, bismuth, copper, mercury, cadmium, lead, and iron.

Researches on the Carbo-Hydrates.—These consist of a memoir upon the acid (levulic) produced by the action of sulphuric acid upon sugar, by A. von Grote and B. Tollens; and a paper on vegetable mucus by W. Kirchner and B. Tollens. The kinds examined are those of the quince and linseed.

Note on Hydrated Parabanic Acid.—B. Tollens.—The author defends the value of his method for preparing this acid against Menschutkin (*Annalen*, 172, p. 175).

MISCELLANEOUS.

The Chair of Natural History in the University of St. Andrews has been offered to and accepted by Prof. Alleyne Nicholson, of the College of Physical Science, Newcastle-on-Tyne. Dr. Nicholson was in no way a candidate, directly or indirectly, for this appointment, but in thus offering it to him unsolicited, the Marquess of Ailsa has the cordial approbation of the University authorities, and may be congratulated in securing for the chair, of which he is patron, so distinguished a naturalist and professor, whose experience extends over two continents.—*Scotsman*, February 22.

MEETINGS FOR THE WEEK.

MONDAY, March 8th.—Medical, 8.	Geographical, 8.30.
—	London Institution, 5.
TUESDAY, 9th.—Civil Engineers, 8.	Photographic, 8.
—	Anthropological, 8.
—	Royal Institution, 3. Alfred H. Garrod, Esq., "On Animal Locomotion."
WEDNESDAY, 10th.—Geological, 8.	Society of Arts, 8.
THURSDAY, 11th.—Royal, 8.30.	Royal Institution, 3. Professor Tyndall, "On Subjects Connected with Electricity."
—	Royal Society Club, 6.30.
FRIDAY, 12th.—Royal Institution, 8. Weekly Evening Meeting. Prof. Abel, "On Accidental Explosions," 9.	Geologists' Association, 8.
—	Quekett Club, 8.
—	Anthropological, 7.30.
SATURDAY 13th.—Royal Institution, 3. Prof. W. K. Clifford, "On the General Features of the History of Science."	

TO CORRESPONDENTS.

A Reader.—Disulphide of carbon.

THE CHEMICAL NEWS.

VOL. XXXI. No. 798.

THE NATURE AND CONSTITUTION OF CAMPHOR AND PHORONE.

By C. T. BLANSHARD.

FROM the fact that camphor differs from borneol by the loss of H_2 , Berthelot inferred that camphor is an aldehyd. Fittig and Tollens have shown (*Ann. der Chem. u. Pharm.*, cxxix., 371) that camphor has none of the properties of an aldehyd, because—

- (1). When heated in a sealed tube with potassium chromate and sulphuric acid, it does not oxidise to $C_{10}H_{16}O_2$, and no acid less oxygenised than $C_{10}H_{16}O_4$, camphoric acid, results from the oxidation of camphor; Berthelot's camphic acid ($C_{10}H_{16}O_2$) being, according to Kachler, only impure campholic acid ($C_{10}H_{18}O_2$).
- (2). It does not reproduce borneol when treated with sodium amalgam, either in alcohol or acetic acid.
- (3). It forms no compound with $NaHSO_3$.
- (4). They were not able to reduce camphoric acid to Berthelot's camphic acid by means of iodide of phosphorus and water.

As camphor was regarded as an aldehyd, without sufficient reason, so, from a solitary reaction, that of its formation, has phorone been called a ketone. The dibasic acids have no ketones. Suberone, the only other body derived from a dibasic acid that has been classified with the acetones, has none of their properties, being oxidised to suberic acid by means of nitric acid. In the formation of camphorone (phorone) according to the following equation:—



there is no condensation of the carbon by the union of two alcohol radicals with (CO), as in the case of the ketones.

The reactions of camphor and phorone, which, as far as they have been studied, are exactly similar, show that these bodies are allied to the phenols.

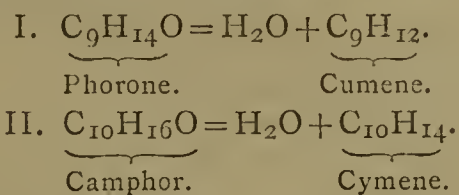
- (1). With PCl_5 , they react to form, respectively, the chlorides $C_{10}H_{15}Cl$ and $C_9H_{13}Cl$, the latter being insoluble in water and soluble in alcohol.

- (2). The body $C_9H_{13}Cl$, treated with ammonia, yields the hydrochlorate of $C_9H_{13}H_2N$, the amide.

- (3). Potassium acts on both camphor and phorone, like phenols, replacing 1 atom of hydrogen in each.

The sodium compound of camphor $C_{10}H_{15}NaO$ (sodium camphate) reacts with ethyl iodide to form the ether $C_{10}H_{15}(C_2H_5)O$ (Baubigny).

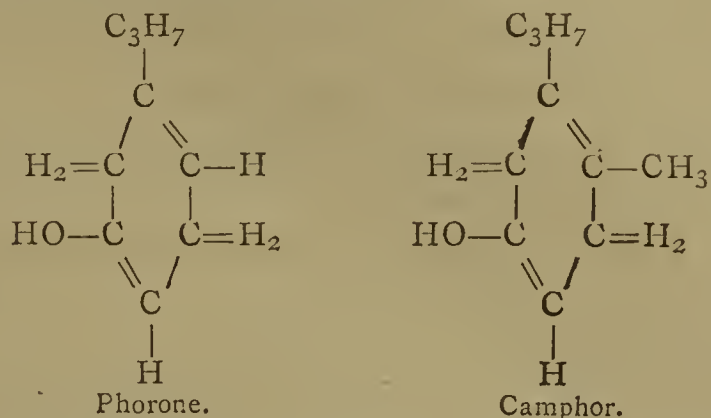
- (4). They behave, when dehydrated by zinc chloride (Gerhardt), like ordinary alcohol, yielding the hydrocarbons less by H_2 than those from which they are derived, thus:—



Thus, all the reactions of camphor and phorone show that they are phenols, and not aldehyds or ketones.

As regards the constitution of these bodies, camphor is cymene (methyl-propyl-benzene) + the elements of water, and phorone is cumene (propyl-benzene) + the elements of water. They are not alcohols, but phenols, as their reactions with metallic potassium and sodium show, coupled with the formation, in the case of phorone, of chloride and amide, and in the case of camphor, of the ether. They are therefore analogous to the complex phenols, *e.g.*, picric acids. They may be classed as aromatic bodies, *i.e.*, bodies allied to, and derived from, benzene; for—

- (1). Camphor is readily and largely soluble in aniline, according to Schiff (*Annalen*, Supp. 3, 361).
- (2). By dehydration they yield homologues of benzene. They may, therefore, be thus represented, according to Kekulé's graphical formulæ:—



The positions of the (CH_3) in camphor, and the (OH) in both camphor and phorone, have yet to be determined for their various isomeric modifications. There should be six modifications of each, the grouping (C_3H_7) being either propyl or isopropyl. The two bodies are thus represented as being exactly analogous, camphor (methyl-phorone) being the homologue of phorone.

When dehydrating agents act on either of these bodies, a hydrogen atom out of each of the (CH_2) groupings unites with the oxygen atom to form water, just as phenol is reduced to benzene by means of zinc fume; the carbon atoms then unite together, as represented in Kekulé's nucleus, to form in each case a homologue of benzene.

Queen's College, Oxford,
March 11th, 1875.

LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE
CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

(Continued from page 64).

LECTURE X.

THE case which came under consideration in the orthorhombic system of a pole lying on one of the great circles of symmetry—*e.g.*, on C at an equal distance from the planes S and Σ —is that in which a transition is made from the orthorhombic system to the tetragonal system. The zone circle passing through such a pole perpendicularly to the great circle, C, fulfils, as we have seen, the conditions for a plane of symmetry. The result of its being so is, that the planes S and Σ are now identical in character—that is to say, are conformable to each other—and we shall indicate them by the same letter, as S_1 and S_2 . The new plane of symmetry, and the supplementary plane corresponding to it, being similar, will be indicated by the letters Σ_1 , Σ_2 , and the systematic triangle of the system will be designated by the expression—

$$\begin{array}{l} S = \Sigma = \frac{\pi}{2} \quad C = \frac{\pi}{4} \\ s = \sigma = 90^\circ \quad c = 45^\circ, \end{array}$$

and the surface of the sphere will be divided into sixteen such triangles.

Taking the planes S as the proto-systematic planes, and the planes Σ and c for the deutero- and trito-systematic planes, respectively, the zone axis [S Σ], which is the normal of the plane c, becomes the morphological axis of the system; and taking the planes S and C for axial planes, their normals present to us three perpendicular axes. A face of a form, the poles of which lie on the great circle, Σ , serves for a parametral plane; and, since the poles of such a face cannot bisect the side, Σ , of a systematic triangle, for the reason already discussed, the face in question

will intersect with the three axes, X and Y, at the same distance a , but with the axis Z with some other parameter, c , so that the axial system becomes—

$$\xi = \eta = \zeta = 90^\circ; 1, 1, \frac{c}{a}.$$

The seven forms of this system are—

1. $\{hkl\}$ the scalene di-octahedron.
2. $\{hol\}$ the isosceles prot-octahedron, or *axial* octahedron.
3. $\{hhl\}$ the isosceles deutero-octahedron, or *diagonal* octahedron.
4. $\{hko\}$ the di-tetragonal prism.
5. $\{100\}$ the tetragonal proto-prism, or axial square prism.
6. $\{110\}$ the tetragonal deutero-prism, or diagonal square prism.
7. $\{001\}$ the tetragonal pinakoid, or *axial* forms.

Of these the "proto-forms" are those of which the poles lie on the great circles S, while the "deutero-forms" or *diagonal* forms have their poles on the great circles Σ .

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 4th, 1875.

Professor ODLING, F.R.S., President, in the Chair.

THE minutes of the previous meeting were read and confirmed, after which Messrs. J. W. Thomas and Henry Shephard were formally admitted Fellows of the Society. The names read for the first time were those of Messrs. M. W. Williams, J. Wilson, and G. E. Davis. Messrs. Charles Thomas Whitmell, B.A., Thomas Howard, Ernest Laremont Fleming, Joseph John Ackworth, Alfred Senier, M.D., Joseph G. Gordon, and James Wilson Bell, and Captain Douglas Galton, F.R.S., were balloted for and duly elected after their names had been read for the third time.

The first paper, "*On the Dissociation of Nitric Acid*," by Messrs. P. BRAHAM and J. W. GATEHOUSE, was read by the former. Three series of experiments were made, the first of which consisted in exposing the vapour of the acid (sp. gr. 1.5) to various temperatures; at that of melted tin only 2.5 per cent of the acid was decomposed, whilst at that of melted lead 20 to 30 per cent was affected, and at a low red heat 54 per cent; at a bright red heat 89. The products are tetroxide of nitrogen, nitrous oxide, oxygen, and nitrogen, the reaction being represented by the equation $8\text{HNO}_3 = 4\text{NO}_2 + 4\text{OH}_2 + \text{N}_2\text{O} + \text{N}_2 + \text{O}_{11}$. A very neat experimental illustration was shown by pouring nitric acid into the bowl of a tobacco-pipe placed in an inclined position, and the stem of which was heated to redness; the evolved gas was collected over water. In the second series, where the acid was exposed to sunlight, it was found that decomposition ceased before the amount of nitrous acid had reached 1.5 per cent. If, however, the products of decomposition are removed as they are formed, the action continues. From the third series of experiments it was found that nitric acid containing nitrous acid is not decomposed by boiling.

The PRESIDENT said the Society was much indebted to the authors for their paper, and especially for the very neat lecture experiment which they had shown.

Dr. ARMSTRONG observed that Mr. Braham had asked for a simple method of analysing a mixture of nitric peroxide, nitrous oxide, oxygen, and nitrogen. He might suggest that a coke ball saturated with sulphuric an-

hydride would absorb the nitric oxide without affecting the nitrous oxide, and the other gases could then be determined in the usual way.

Mr. BRAHAM then exhibited an experiment, in which he exhausted a glass receiver; and after allowing the air to re-enter through a large opening until equilibrium was restored, the opening was closed, and the vessel connected with a pressure gauge. In the course of a minute the mercury had risen through the space of an inch. A converse experiment was made by pumping air into a glass vessel, allowing it to escape, and then closing the opening. In a short time there was an appreciable pressure within the vessel.

Many suggestions were offered by various members of the Society in explanation of these phenomena, after which Dr. THUDICHUM addressed the Society "*On the Chemical Constitution of the Brain*." He said he thought the best way of bringing the substance of his researches before the Society would be to explain the table of the constituents of the brain which was hanging on the wall:—

TABLE SHOWING CONSTITUENTS OF THE BRAIN.

<i>Group of Sulphurised Principles.</i>	
Albumin,	$\text{C}_{72}\text{H}_{112}\text{N}_{18}\text{SO}_{22}$
<i>Group of Phosphorised Principles.</i>	
<i>Sub-group of Kephalins.</i>	
Kephalin,	$\text{C}_{42}\text{H}_{79}\text{NPO}_{13}$
Kephaloidin,	$\text{C}_{42}\text{H}_{79}\text{NPO}_{13}$
Oxykephalin,	$\text{C}_{42}\text{H}_{79}\text{NPO}_{14}$
Peroxykephalin,	$\text{C}_{42}\text{H}_{79}\text{NPO}_{15}$
Amido-kephalin,	$\text{C}_{42}\text{H}_{80}\text{N}_2\text{PO}_{13}$
Compounds with PtCl_4 ; CdCl_2 ; Pb ; acids, bases, and salts.	
<i>Sub-group of Myelins.</i>	
Myelin,	$\text{C}_{40}\text{H}_{85}\text{NPO}_8$
Oxymyelin,	$\text{C}_{40}\text{H}_{75}\text{NPO}_{10}$
Amido-myelin,	$\text{C}_{40}\text{H}_{82}\text{N}_2\text{PO}_{10}$
Compounds as kephalin.	
<i>Sub-group of Lecithins.</i>	
Lecithin,	$\text{C}_{42}\text{H}_{83}\text{NPO}_9$
Compounds as kephalin.	
<i>Group of Nitrogenised Principles.</i>	
Cerebrin,	$\text{C}_{34}\text{H}_{68}\text{N}_2\text{O}_8$
Stearoconote,	$\text{C}_{34}\text{H}_{68}\text{N}_2\text{O}_8$
Phrenosin,	$\text{C}_{34}\text{H}_{67}\text{NO}_8$
Kerasin,	$\text{C}_{46}\text{H}_{91}\text{NO}_9$
Extractive and secretory acids.	
Uric acid and congeners.	
New acid.	
Extractive alkaloids, No. 1 and No. 2.	
Urea and amido-acids.	
<i>Group of Oxygenated Principles.</i>	
Cholesterin,	$\text{C}_{26}\text{H}_{44}\text{O}$
Inosite,	$\text{C}_6\text{H}_{12}\text{O}_6$
Lactic and formic acids.	
Fats and fatty acids.	
<i>Group of Inorganic Principles.</i>	
H_2SO_4 ; HCl ; P_2O_5 ; CO_2 ; H_2OK ; Na ; NH_3 ; Ca ; Mg ; Cu ; Fe ; Mn .	

This subject, which was one of great difficulty, had occupied him many years, and he had found that it was quite useless to work on the small scale; in fact, before anything could be done, 1000 brains had to be subjected to chemical examination. Of the constituents of the brain, nearly all the albumin present was in the insoluble form. The group of the phosphorised principles, to which he had principally directed his attention, consisting of the kephalins, myelins, and lecithins, all contained phosphorus, as glycono-phosphoric acid. There were also present nitrogenised principles, oxygenised principles, inorganic matter, and about 80 per cent of water. The water is very difficult to remove from the brain matter, but it can be done by slicing it thin, and soaking it in successive quantities of strong alcohol. The dried product is then finely divided and rubbed through a sieve. Heated to 45°C . with alcohol,

it leaves albumin, and the solution deposits a white matter, containing most of the phosphorised principles, all the nitrogenised, and much of the cholesterin. The alcoholic solution, when concentrated, deposits the lecithins, and by further evaporation the fatty ethers. The constituents of the white matter may be separated by treatment with ether, which extracts the kephalins; on concentrating the solution and adding alcohol, these are precipitated. The myelins are only slightly soluble in ether, but may be dissolved out by absolute alcohol, which leaves the cerebrin, phrenosin, and kersin.

All the phosphorised principles are soluble in water, but the kephalins as a class are characterised by the property of oxidisability, turning red in contact with ether, whilst the myelins, on the contrary, possess great stability, and are therefore readily obtained colourless and crystallised. Hydrochloric acid, or any salt, readily precipitates the phosphorised compounds, but when dialysed the combined reagents pass off, and the substances again pass into solution, affording an excellent method of purifying them. The phosphorus is always present as glycerophosphoric acid.

The author then explained his theory of the constitutional structure of the various compounds, after which he shortly noticed the members of the nitrogenised group, of which phrenosin, $C_{34}H_{67}NO_8$ may be considered as the monoamidated form of a fatty acid, whilst cerebrin, $C_{34}H_{68}N_2O_8$ is the diamidated form. Kersin, $C_{46}H_{91}NO_9$, the third on the list, is a colourless crystalline substance. All these compounds give a purple colour when treated with sulphuric acid and sugar (Pettenkofer's reaction). Stearoconote has the same composition as cerebrin, and can easily be converted into it by boiling with hydrochloric acid and benzene; cerebrin can also be reconverted into stearoconote.

The amount of these principles is considerable, the phosphorised and nitrogenised compounds with the cholesterin constituting 5 per cent of the brain.

The CHAIRMAN, in thanking the author, said he need not remind the Fellows that this class of investigations was of the most difficult kind, and especially the brain, which required more than ordinary boldness to attack it.

In answer to a question by Dr. Wright, Dr. THUDICHUM replied that the examination was conducted on normal brains from human subjects, controlled by experiments on the brains of oxen. In softening of the brain he had found free glycerophosphoric acid and fatty acids.

Mr. C. T. KINGZETT then read a paper on "*Calcic Hypochlorite from Bleaching-Powder.*" After a brief summary of what was already known on the subject of bleaching-powder, the author said he had observed that needle-shaped crystals were formed in a saturated solution of bleaching-powder which had been exposed during a frosty night. On freezing a concentrated solution of bleaching-powder, breaking it up, and throwing it on a filter, the mass gradually thawed, leaving on the filter feather-like crystals. Similar crystals are obtained on evaporating a solution *in vacuo* over sulphuric acid and potash. The author has analysed these crystals, and found them to be calcium hypochlorite, a body never before isolated. The bearing of these facts on the constitution of bleaching-powder was then pointed out.

The CHAIRMAN having thanked the author,

Mr. W. NOEL HARTLEY read a note "*On a Simple Method of Determining Iron.*" This process was originally devised as a rough and ready one in the absence of proper chemical apparatus, but has since proved to be remarkably accurate, and a good method for students beginning quantitative analyses. Equal weights of the ore to be examined and of fine iron wire (about 4 or 5 grms.) are dissolved and made up to the same bulk. A pipette full of each solution is then taken, and the ferric salt reduced to the ferrous state by warming with granulated zinc. Permanganate is used for the titration, the comparative amounts required for the pure iron and for the ore giving the percentage of iron in the latter.

The thanks of the Society having been given to Mr. Hartley for his practical and ready method of determining iron, the meeting was adjourned until Thursday, March 18th, when Dr. Hofmann will deliver the Faraday lecture at the Royal Institution "On Liebig's Contributions to Experimental Chemistry."

PHYSICAL SOCIETY.

February 27th, 1875.

Professor J. H. GLADSTONE, F.R.S., President, in the Chair.

MR. WILLS, F.C.S., submitted to the Society apparatus which he had devised for exhibiting the sodium spectrum to an audience. The experiment, as usually shown, consists in volatilising the metal or one of its salts between the carbon poles of a battery, and in projecting the spectrum on to a screen. The method is imperfect, as the characteristic lines of sodium are always associated with the continuous spectrum of the electric light. Mr. Wills prefers, therefore, to obtain a sodium flame by burning hydrogen which has been passed over the surface of molten metal; by this means a pure sodium spectrum may be thrown on the screen.

Professor McLEOD suggested that other metals might be introduced into the hydrogen flame in a finely-divided state, and that the continuous spectrum might be eliminated by employing a horizontal slit.

Professor G. C. FOSTER then read a paper by himself, and Mr. J. O. LODGE "*On the Lines of Flow and Equipotential Lines in a Uniform Conducting Sheet.*" The first experimenter who worked on this subject was Kirchhoff, who used plates of copper, but owing to their small dimensions his measurements were imperfect. Quincke employed rectangular plates, and afterwards discs of lead and copper conjointly, so that he obtained a difference of potential at the junction. The next experiments were made by Professor Robertson Smith, who used conducting discs of tin-foil and deduced equipotential lines from the lines of flow. Professor Foster stated that the general mathematical theory had been fully established by Kirchhoff, who had verified it experimentally in all its main features. The object the authors of this paper had in view was to show that Kirchhoff's results can be arrived at by very simple mathematical processes, if each electrode by which electricity is supplied to or taken from the sheet be regarded as producing everywhere the same effect as it would if it were the only electrode in the sheet. The electrical condition of every point in the sheet thus appears to result from the simple superposition of the effects due to the several electrodes.

This mode of treating the question has been adopted by Professor Robertson Smith; but his paper was in the main addressed to mathematical readers. It was the aim of the authors, however, to show that the chief results could be established by elementary methods, which can be included in ordinary class teaching. The paper contained, in addition to the mathematical discussion of the subject, a description of an experimental method of laying down the equipotential lines on a conducting surface, so that the difference of potential between any two consecutive lines may be constant. Measurements were also given of the resistance of discs of tin-foil of various sizes, and with the electrodes in various positions. The results agreed closely with the calculated values, and thus supplied a verification of the theory which Kirchhoff had been unable to obtain, in consequence of the small resistance of the discs used by him.

Mr. LATIMER CLARK made some observations on the methods by which contact was made between the electrodes and the conducting sheet, and Professor ADAMS then described some of the results which he had just communicated to the Royal Society "*On Lines of Force.*"

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

THE following discussion ensued after the reading of Dr. Stevenson's paper on the "Decomposition of Milk," read at the meeting on February 5th, 1875:—

Mr. CLEAVER—I have here some results of observations on the decomposition of milk extending over the last six months. I first of all made some experiments about six months ago. I took a sample of milk, and analysed it when I bought it. I then put a dozen samples into different bottles, and sealed them up, and opened one every day and examined it. After three weeks I found the total solids had diminished from 12.48 to 11.98, but the fat in that time had scarcely altered at all; so I concluded that the whole of the decomposition was there due to the alteration of the nitrogenous matter in the milk. That milk was kept at a temperature of 70° F. for the whole time. I then thought that I would make some further experiments, extending over a longer time, with good and poor milks, and kept at different temperatures, and in stoppered and unstoppered bottles. The following are the results:—

Samples.	Time of Keeping.	Temp.	Diminution of Total Solids.
2 samples.	{ Dec. 8, 1874, to Jan. 15, 1875 }	70° F.	From 11.14 to 10.34
1 sample.	" "	" "	" 11.96 ,, 11.12
" "	" "	55° F.	" 11.14 ,, 10.56
(The fat had undergone the same amount of alteration.)			
1 sample.	6 weeks	55° F.	From 11.96 to 11.32
" "	{ Aug. 28, 1874, to Jan. 15, 1875 }	70° F.	" 11.92 ,, 9.26
" "	" "	" "	" 14.00 ,, 10.64
" "	" "	55° F.	" 11.20 ,, 9.76
" "	" "	" "	" 14.00 ,, 11.04

All these samples had been kept in closed bottles. There was a slight escape of gas when the bottles were opened, but the samples had only a slight cheesy smell, and there was no mould upon them at all. Some other samples that had been kept in open bottles formed a dense mould, and had a very bad smell. The following are some of the results:—

Samples.	Time of Keeping.	Temp.	Diminution of Total Solids.
1 sample.	4 months	70° F.	From 12.0 to 6.30
" "	2½ "	" "	" 9.9 ,, 9.72
" "	" "	" "	" 12.3 ,, 9.62

I think that the results of those first experiments, in which the milk was kept in closed bottles at 70° F., shows that the decomposition goes on in a tolerably regular manner, namely, at the rate of about 0.7 per month. The experiments show the same rate of decomposition ranging from three weeks to over four months. There is one thing to be noticed with regard to the diminished amount of ash. I found that there was always a deposit of mineral matter on the side of the bottle. What it was I did not examine. There was also a slight deposit which would not come off by shaking up the milk. I also tried the effect of adding sodium carbonate for the exact neutralisation of the acid in the milk; but I found that the results did not come out differently from those obtained when the milk was evaporated in an open vessel, without the addition of sodium carbonate.

Dr. MUTER—I have been for some time back making experiments on this point. I have kept milk in this way for certain fixed times, and I have found that all of them, except one, underwent a loss in the month of about 0.5. There was one of them which had not lost more than 1/30ths. That one milk stood apart from all the rest, and behaved differently. I ascertained what is the change that goes on. I have found, in all those milks that had

lost, an increase in the weight of the material extracted, and I found that it was lactic acid which gave me the slight increase. I estimated the acid volumetrically, but I forget, for the moment, what it was; but there was no doubt that there was an increase after extraction by ether in that way.

Mr. ALLEN—I have had no experience in the analysis of old milk of this sort, but I found in the case of urine that it could be kept very successfully, for a long while, by adding a drop or two of carbolic acid to it. I would suggest the possibility of using the same thing in the case of milk. It is volatile, and you might be able to get it off from the residue, or if not you might add a known quantity with a certain amount of soda, as carbonate of soda, and see whether that would keep the milk.

Mr. WANKLYN—My experience on the keeping of milk is this:—Within a week there is very little alteration, even in summer; that is to say, the analytical results that you get from it will not vary much within the first week. But after the first week milk is uncertain, and my experience is that occasionally milk will keep for weeks, and will show you the same analytical results as at first, and occasionally milks will decay very much even when they are tightly corked; but after the first week I think we cannot depend upon the results. Then when milk is a day or two old it will very often be observed that the solid residue is slightly brown. This is occasioned, I believe, by a slight production of lactic acid, which chars the milk sugar; but the charring is so small that, though a colour is produced, there is no difference in the weight that we can perceive. With regard to the mode of dealing with very old milk, I once had occasion to deal with a very old milk, and I adopted the plan of taking the ash, and I took the ash of 50 c.c., and obtained perfectly normal results. I believe the only satisfactory way of dealing with very old milk, in order to answer the question of watering, is by taking the ash; and, if anything further were wanted, I should be inclined not to take the chlorine, but to determine the phosphoric acid. I think it would be worth while to make investigations in that direction, for there is a great chance of the phosphates in milk being very constant.

Dr. REDWOOD—The ash in genuine milk, according to my experience, varies from about 0.65, in the 100 parts by weight, to very nearly 0.8; and in one or two instances I found it to be above 0.8, and that variation—looking to the smallness of the quantity of the ash in relation to the milk itself—is rather a considerable variation, for it seems to me very difficult, by reference to the ash alone, to come to any very definite conclusion. I have had some experience in reference to milk that has been kept for some time, and I may state generally that I agree with what Mr. Cleaver has indicated this evening, that the amount of deterioration or alteration of milk greatly depends upon the temperature at which it is kept, and the extent to which it is exposed to air; and milk, if it is kept in a filled and closed vessel, at a temperature not rising above 55 or 60 degrees, undergoes very little change in the course of even three or four weeks. I have kept a great number of samples of milk for very nearly a month, in a cold place, in bottles that were well corked and sealed, and found that, upon opening them, there has been very little gas evolved, very little acidity in the milk, and very little variation in the total residue on evaporation as compared with that taken when the milk was fresh. But where the temperature is higher—for instance, in summer weather, when the temperature ranges from 70 to 80 degrees—a very material change takes place in even a shorter period.

Mr. CLEAVER—I may state that I have found that, in the milk of cows that have just calved, the ash has gone up to 1 per cent, but that milk contained 28 per cent of solid, 12 per cent of which was albumen; and in several cases which I have examined, when there has been from 4 to 8 per cent of albumen, the ash has always been 0.8 or 0.9, or perhaps 1 per cent.

Dr. STEVENSON—Of course when milk becomes stinking and putrid, and has decidedly a butyric odour, it is not often that we get samples of it, because they elude us by bursting the bottles in which they are kept, in consequence of the gas evolved. In milk covered with fungous growth I have noticed the deposit on the side of the bottle, but I have not examined it, and I cannot say that it is oxalate of lime. The milk ash is of some importance. I have not noticed the wide variations which Dr. Redwood has mentioned. I agree with Mr. Wanklyn that the ash of milk follows pretty generally the caseine in it; and Mr. Cleaver's results of course show that when milks contain a high percentage of albumenoids there is a high percentage of ash, as one might expect. I cannot confirm Mr. Cleaver's experiments with regard to the rate of decomposition. He makes it almost a constant rate of progression per month, but I have found that not so. I have found the decomposition to go on more quickly in some than others, and I could not myself form a ratio. In two reference cases which have come under my notice the milk had kept with remarkable constancy. The result was that the solid matter did not vary $\frac{1}{10}$ th per cent, and the amount of water came out exactly, or did not vary $\frac{1}{2}$ per cent from that which I had originally returned. In that case the milk kept from about the 21st of November to about the end of the first week in January. It was fortunately kept in a cool place, and the weather was remarkably cool, and the bottle was full and sealed. The other case occurred last winter. The milk had been kept about a month. The result of my analysis almost exactly confirmed the original analysis of Prof. Attfield, but in that case there was not the slightest putrescent odour in the milk. I find that when you get a cheesy, or butyric, or putrid odour the results are unreliable.

The following paper was read by Mr. G. W. WIGNER at a meeting of the National Association for the Promotion of Social Science, March 10th, 1875 :—

ADULTERATION AND ADULTERATION ACTS,
WITH SPECIAL REFERENCE TO THE
"SALE OF FOOD AND DRUGS ACT, 1875."*

THE introduction of the Bill now before Parliament has been the occasion of my submitting to your notice the following remarks; but, to make them intelligible, it is necessary that I should refer shortly to the older adulterations and to the older Acts. I may premise that, by the term "adulteration," than which no word that I know of has been found more difficult to define, I understand, for the purposes of this paper, the various methods which at different periods have been resorted to, for sophisticating, reducing, or debasing the quality or the value of articles of diet. Some people may be supposed to imagine, from the amount of discussion which has of late years taken place on the subject, that "adulteration" is more or less a new thing—that it came in with the introduction of railways, or was caused by the first Reform Bill, or the Repeal of the Corn Laws. It is, however, a plant of no such mushroom growth. It flourished in the days of our remote ancestors; it withstood revolutions, and survived changes of dynasty; and it may be, that when Lord Macaulay's irrepressible New Zealander shall have completed his artistic studies, he may have to betake himself from the "broken arch of London Bridge," to the same task as that which occupies Mr. Sclater-Booth to-day. We find that, in the days of the Henry's, the Charles's, and the George's, as in the days of Victoria, the much derided "wisdom of our forefathers" had to be devoted to the framing of measures for the same object as that to which the attention of our present legislators is directed. It seems to me that the object and the scope of any Act for the repression of adulteration should be to protect the public health and the public pocket; in short, to contrive that the consumer is supplied with a wholesome article and gets fair value for his money. These two points, I conceive, cover the whole ground. Amongst the earliest Acts for the

repression of adulteration, we find that in the time of Henry III. a law was passed, forbidding the sale to His Majesty's subjects of unwholesome wine and meat. In the reign of Charles II., the subject of the adulteration of wine was again dealt with, and in that of George IV., a very stringent Act for the prevention of the adulteration of bread was passed, it being enacted that any person using alum, "or any preparation or mixture in which alum shall be an ingredient," in the manufacture of bread, should be subject to a fine of not more than £20, or in default to a term of imprisonment, varying from three to twelve months. By this Act power was also given to certain officials to enter the premises of any baker, to search for, and if found, to seize any bread so adulterated, or the ingredients, presumably intended to be used for such adulteration, the baker in whose premises such articles were found being subjected to the same penalties as those I have just mentioned. Another clause also provided for the punishment of any person obstructing or hindering such officers in the execution of the duty just pointed out. These clauses were certainly as stringent as any to which the most "harassed" trade in our time, even that of the publican, has been subjected. We find that from time to time various Acts were passed for the prevention of the adulteration of tea, beer, coffee, cocoa, &c., and it may be mentioned as a curious fact that, in an Act of 1777, it was made punishable with a fine of five pounds, to "mix," "colour," or "stain" tea, and that this exact phraseology is reproduced in the Act of 1875. No attempt, however, was made to grapple with the subject as a whole till the year 1860, when the first general Adulteration Act was passed. This was led up to or brought about mainly as the outcome of the *Lancet* Commission, of which Dr. Hassall was the chief, and the results of that gentleman's extensive examination of the quality of the various articles of food and drink usually sold, were astounding. Dr. Hassall found, *inter alia*, that tea was all but universally adulterated, and that, with such various foreign substances, as "lie tea," "exhausted leaves," "starch," Prussian blue, "China clay," "turmeric," &c. He found that it was next to impossible to obtain either a pure loaf of bread or a pure pint of milk, the former being adulterated with alum, and the latter "let down" with water. Of 49 samples of bread taken consecutively, not a single one was pure and at least half the samples of milk were watered, the diluent in some cases being to the extent of 50 per cent. More than 80 per cent of the coffee was adulterated, the debasing materials used being beans, mangel wurzel, chicory, acorns, and other adulterants "too numerous to mention." Pepper was mixed with wheat, mustard, rice, linseed, &c. Chicory, itself an adulterant extensively used, was sometimes rendered still further objectionable by the admixture of burnt and powdered carrot. Cocoa having first been depreciated by the addition of flour or starch, had its original colour reproduced by the help of sundry earthy colouring matters. Not a single sample of pickles was found to be uncontaminated with copper, and even ground spices were reduced in quality by the addition of flour, sago, and arrowroot. Of course, considering that Dr. Hassall's researches extended to *all* articles of diet it was only to be expected that he would meet with some to adulterate which was either impossible, very difficult, or unprofitable; but taking the many hundreds of samples which he analysed in the aggregate, including those grossly adulterated, slightly adulterated, and those more or less pure, it was found that something like 65 per cent were adulterated, the fair presumption being that amongst the *poorer* classes, such a thing as purity in the articles of their daily consumption was all but unknown. Mr. Wanklyn made the analysis of milk his speciality, and of 56 samples taken from the London Workhouses, he only found 6 that were pure. He also examined many hundreds of samples of milk in different parts of the country, and though I regret that I have not the actual figures before me, I may mention that he found

adulteration to be the rule and purity the exception; and as a proof of the correctness of his results, it may be noted that though he published the names and addresses of all the delinquents, he had not to defend a single action for libel, though I believe one was threatened. After these disclosures the Act of 1860 was passed, and undoubtedly was productive of some alleviation to the poisoned and cheated consumer, but this was chiefly from its *deterrent* influence; for, from its defective machinery, only three or four analysts were appointed, but very few prosecutions were instituted, and as far as I can ascertain only about 300 samples were analysed in all. The Act became, therefore, virtually a dead letter, and for twelve years the adulterators had it pretty much their own way. They became more expert at their work, and from time to time devised improved methods of "committing the oldest crimes the newest kind of ways;" and when at length, in 1872, when the evil had become too glaring, and the public patience again gave way, they resented with virtuous indignation any interference with their time-honoured "usages of trade," and immediately that the last Bill was passed, they discovered that they were the victims of oppression and injustice. That this Act has been productive of much good is evidenced by the outcry which the tradesmen have made against it. It is noticeable that, in the majority of cases of "hardship," "oppression," &c., the defence has *not* been that a man was punished for selling, as impure, an article that was really pure, but that he bought it in the same condition as he sold it; and this is a point which I contend should never be admitted as a sufficient excuse. The object of an Adulteration Act is, or ought to be, to protect the *public*. The wholesale and the retail dealer should be left to make what arrangements they please between themselves, but the *public* should not suffer; and if a shopkeeper is so ignorant as not to know whether he is selling adulterated or unadulterated articles, the sooner he selects some humbler occupation which he does understand the better. But the tradesmen, after these many years of immunity, had "waxed fat," and become a great power in the country. They had their advocates in the press, and their representatives in Parliament, and with a dogged determination worthy of a better cause they resolved to "die hard." They protested that adulteration was in itself a good thing; that their fathers and their grandfathers had practised it, and that they were all "most respectable men." They maintained that they knew better than their customers did what their customers really wanted; that when a man asked for "tea" he would be disappointed if he did not have it heavily "faced;" that if he asked for "coffee" it was only his ignorance which prompted him to use such a word, for what he really required was a totally different substance, known to the "trade" as chicory; that when he asked for "mustard" he didn't *mean* mustard, but a mixture in about equal quantities of mustard and flour, delicately tinted with turmeric; that bread, *minus* alum, was unsightly if not unwholesome, and that undiluted milk was not suitable to the English palate. As to the gentlemen who had accepted appointments as "public analysts," they mocked at their science and derided their ability, and this to such good effect that it became the exception to find the word "analyst" in some newspapers, without the flattering prefix of "incompetent." The upshot of this long and loud "cry of the oppressed" was the appointment of the Select Committee which sat last year. Of this Committee I would speak with the utmost respect, composed as it was of honourable and high-minded gentlemen, and if it was tinged with a leaning to the side of the tradesmen rather than to that of the public, perhaps the same objection might be made to the composition of the House of Commons itself. This Committee applied itself to its task with admirable industry. They heard the opinions of numerous tradesmen, and the evidence of two or three analysts, and ultimately they issued a report, in which they admitted that they had come to the conclusion

that the Act of 1872 had "done much good," but at the same time they considered that there had been some cases of hardship, and so they thought some alteration in the law should be made. They had not, however, before them any tabulated or authentic returns of the actual results of the working of the Act, but these results I have (acting on behalf of the Society of Public Analysts), within the last few days got together and collated, and they are as follow:—Returns have been received from 60 districts, showing, during an average period of 16 months, the number of samples analysed and the proportion found to be adulterated:—

Total number of samples analysed.. .. 14383

Total number found to be adulterated .. 3774

Being about 26 per cent of the whole. Of the 3774 adulterated, 1066 were samples of milk. A comparison of these figures, with the results which I have already quoted of Dr. Hassall's investigations some years ago, clearly demonstrate that a striking improvement has taken place in the quality of the articles of general consumption. As a pendant to the foregoing table, I will trouble you with a word or two as to my own experience as a public analyst for three of the largest metropolitan districts. I have examined within eighteen months upwards of 700 samples of articles of food and drink, of which 84, or *rather less than 12 per cent, were found to be adulterated*; but if I averaged the samples submitted to me during the last six months, the proportion of adulterated ones would be very much reduced. For instance, a little more than a year ago, almost every sample of bread I examined was adulterated with alum in greater or less proportions. For some months past I have not found a trace of alum in any bread I have examined; of 16 consecutive samples of milk taken in 1873, 14 were either skimmed or watered; of 13 samples recently taken from the same district, only 2 were adulterated. The Committee having made the report, with which no doubt you are familiar, it was evident that further legislation was contemplated, but the Government having only recently acceded to office, and having many other matters on their hands, postponed bringing in a Bill until this session, in order that the measure might be a comprehensive and well matured one. The Bill is now before us, and it is only a mild criticism to say that it does not strike the reader as being characterised by any particular signs, either of deep meditation or of profound acquaintance with the subject with which it deals. In considering the "Sale of Food and Drugs Act, 1875," I wish it to be most distinctly understood that I give the Government credit for the most beneficent intentions, but as this is a matter about which we cannot afford to take "the will for the deed," I will endeavour to point out fairly, and with as much clearness as I can, the defects of the proposed measure.

Clause 1 repeals all previous enactments, from which we are to understand that the present Bill is complete in itself.

Clause 2 restricts the Act to England, though the previous Acts included Scotland and Ireland in their operation; but as there would appear to be some confusion in the mind of the Government itself as to whether or not this is really intended, I pass this clause by without further comment.

Clause 3 defines the meaning of *food* as "Every article eaten or drunk other than drugs." This is all very well as far as it goes, but I think it lacks exactness, as it might be argued that certain substances, such as tea and coffee, are, in their natural state, neither "eaten" nor "drunk." "Any article of food or drink," or "Any article used for the purpose of food or drink," would, I think, be preferable; or if we could condescend to go to our Colonies for a definition, I think we might advantageously copy one which occurs in an Adulteration Act passed by the Canadian Parliament last year. It runs thus:—

"Food means and includes every article used as food in the state in which it is offered for sale, or that is

used in the preparation of food by admixture therewith, either before, during, or after cooking."

"*Drink* means and includes any liquid used as a beverage, and any article used in or for the preparation or partial preparation of any beverage."

I will now read Clauses 4, 6, 7, 8, and I must ask the meeting to follow me closely. [Read clauses.] Now I will undertake to prove, from the clauses I have just read, that under this Act any possible means of adulteration may be practised with impunity. Clause 4 says—"No person shall knowingly mix, colour, &c., any article, &c., with any ingredient of a nature injurious to health." First of all, this clause does not mean what it says. It clearly means that the penalty shall be incurred for "*rendering an article as sold injurious to health*," as there are innumerable substances used, and fairly used, in the manufacture of articles of food which, if eaten or drunk by themselves, would be not only "injurious to health," but actually poisonous; take, for instance, yeast in bread, and essence of bitter almonds in confectionery. However, leaving this and taking the evident meaning of the clause, we come to this word "*knowingly*," which also occurs in Clauses 5, 6, and 9. A man must add these forbidden ingredients *knowing* them to be injurious to health; but how if he doesn't know or professes not to know? or, if he does know, how is his knowledge of their effects to be proved? "Ignorance" will certainly be "bliss," for whenever action is taken against a man he has only to plead that he *didn't know any better*. Surely this is setting a premium on ignorance, and the intelligent and honest trader will stand at a great disadvantage as against his ignorant or unscrupulous brother. Clause 6 says that a man shall not "knowingly sell any article not of the nature, substance, and quality of the article demanded;" but here again he has only got to stick to ignorance, and he is safe. Suppose he admits that he does know,—that when he has been asked for one article he has supplied another,—he still runs a very small risk of being punished, for he can plead that the adulterant has been added for the purpose of rendering the article "palatable," or of "improving its appearance;" and what is palatable and what is pretty being purely matters of opinion, the vendor will have a right to urge that his is of as much value as that of the opposite side,—and the addition of alum to bread does certainly improve its appearance. But, as if this poor innocent tradesman were not sufficiently guarded from the possibility of a conviction, he is allowed also to urge that the adulterated article is mixed "in accordance with the usage of trade." This is exemplifying the maxim that "whatever is, is right" with a vengeance. He has only got to show that his neighbours are as guilty as himself to prove that he is not guilty at all. If it is the practice in a certain district (as it has been in some districts) to add 50 per cent of water to milk, this "usage of trade" is to receive legislative approval. He can also successfully plead several other "exceptions," but it is hardly worth mentioning them, as, if those I have alluded to are allowed to stand, it matters little what is added to them; but I may mention that, under the first exception of Clause 6, salt or carbonate of soda might be added to milk, to the injury of young and delicate children. But if, by any extraordinary perversion of justice, or if, because the trader is too ignorant to avail himself of any of these "exceptions" so kindly provided for him, he should run the risk of being convicted, Clause 8 steps in, and takes care of him. It says, in effect, "So long as you do not poison your customers, in case we have not made the 'exceptions' elastic enough for you, you are hereby authorised to adulterate your wares with *whatever* substances and to *whatever* extent you think fit, if you take care to affix or hand the purchaser a label stating that the article is 'mixed'—the sort of label, the size of the type, and whether to be fixed inside or outside of the parcel, and all such little matters, being left to your own discretion." The intention

of this clause is, I am free to admit, very praiseworthy, and I think that if it were enacted that the label should be printed in distinct and legible type, and that it should bear the minimum proportion of the substance under the name of which the article was sold, it might work well: for instance, it should not be allowable for a man to sell simply "a mixture of chicory and coffee," but the label should state that "This is sold as a mixture of chicory and coffee, and contains more than (so much) per cent of coffee," so that the purchaser may know whether he is buying 25 per cent of chicory and 75 per cent of coffee, or *vice versa*. In the sixth exception under Clause 6 it is enacted that a drug may be sold not "of the nature, substance, and quality," of that asked if sold according "to the usage of trade." As it is manifestly extremely desirable that drugs should be sold in a pure state, it would be much better to say "or in accordance with the standard laid down by the British Pharmacopœia, or by approved works of Materia Medica." In Clause 9 it is made punishable to "abstract from an article of food any part of it so as to affect injuriously its quality, substance, or nature," or to sell an article from which such abstraction has been made; but in both cases this inevitable word "*knowingly*" creeps in, and nullifies what would otherwise be a very good clause.

Clause 10 is a very long one, but I have only one remark to make about it. It enumerates various local authorities, and says they "*may*" appoint Analysts. Now, for an Adulteration Act to be effective, its application should be universal, and I can see no just reason why—without unduly burdening the smaller districts, which might easily be grouped—the most obscure, as well as the largest, places should not have the benefit of having their articles of diet examined. It would be well, also, if it were made imperative that the Analyst should examine quarterly some minimum number of samples, which number could be fixed at so many per thousand of the inhabitants.

After having had to criticise this Bill so far adversely, it is pleasant to find something to approve of, and in Clause 13 I think it is a very wise provision to empower Medical Officers of Health to procure samples for analysis, seeing that they have peculiar opportunities for observing the evil effects of the consumption of adulterated viands, and for judging as to the likelihood or otherwise of certain substances being adulterated.

In Clause 14 I have only one fault to find, but it is a serious one. The Inspectors appointed to purchase samples for analysis are, of course, paid a salary for the execution of such duty, and of course pay for such samples out of public money, and it has always hitherto been part of their duty—after having duly purchased such samples—to take them at once to the Analyst for the district, but this clause says they shall only do so "if they deem it right to have the article analysed." I think the absurdity of leaving any option to the Inspectors must be obvious. Take an extreme case. You might have in a district an able and willing Analyst anxious to do his duty, a Local Authority also anxious that the Act should be fully put into operation, two or three paid Inspectors, told off for the express purpose of purchasing samples, and yet, if they "*deemed it right*," these Inspectors might, after going through all the ceremony of purchasing, paying for, sealing, and dividing a number of samples, dispose of them in any way they "*deemed right*;" and in spite of all the organised machinery for having articles analysed, the Analyst might never have a sample brought to him at all.

Clause 16 provides that when the Analyst resides more than two miles from the place where the samples are purchased, a personal delivery of them by the Inspector may be dispensed with, but the only other means of conveyance is to be by sending them through the post-office as registered letters. A difficulty I see about this is, that I have frequently had say half-a-dozen quartern loaves of bread brought to me in one day, and I am in doubt whether

the Postmaster-General would be willing to convey them as "registered letters."

Clause 17 provides that if a vendor refuses to supply an Inspector with a sample of any goods which he exposes for sale, on having the value of such sample tendered to him, he shall be liable to be fined £5 for such refusal. To this clause I have no exception to take. I think it is a perfectly fair and reasonable one.

Clause 22 deals with cases where defendants challenge the correctness of the analysis, and request that a second one may be made, and it enacts that a magistrate may refer the sample to "the Analyst of an *adjoining* district, who shall analyse it as if he were applied to by any officer in his district." For "adjoining" I would substitute "another," so as not to unduly curtail the magistrate's choice; and there would certainly be no justice in an Analyst being compelled to analyse a *strange* sample "as if he were applied to by any officer in his own district," as this would really be to analyse it for nothing, or next to nothing, he being "in his own district" paid by a salary, and if by any fees for individual samples, such fees being only in addition to his salary. With the alteration and excision I have mentioned this clause would, I think, be practicable.

Clause 25 seeks to protect the retail tradesman from being deceived by the wholesale dealer from whom he buys, and says that if he can produce a "warranty" from the latter he shall be acquitted. The intention of this is admirable, but there is a large loophole. The retailer goes free on production of a warranty of the purity of an article which has been found to be adulterated, but no provision whatever is made for touching the wholesale man who gave the false warranty. Unless this be altered, so that in cases of the sale of adulterated articles the law may lay hold of somebody, it is not difficult to foresee that there will be a great number of warranties soon afloat, and it is equally clear that, except for the purpose of furthering adulteration, they will not be worth the paper on which they are written.

In Clause 20, I think it should be ordered that, in the case of a second offence, proceedings against the offender should be compulsory. As a schedule to this Act is printed a curious and cumbrous form of certificate for analysts to use, but it is so utterly impracticable that I must suppose it to have been drawn by some gentleman who was totally unacquainted alike with the requirements and the possibilities of the range of an analyst's certificate. There are numerous other points in this Bill to which I might have adverted, but they will doubtless be touched upon by the speakers who will follow me. I shall, I think, have made it sufficiently apparent that, in my opinion, the Bill, as it stands in its entirety, is a retrograde bill, and if passed would tend to the encouragement, not to the repression, of adulteration. It has occurred to me and to some other people that it would have been much simpler to have simply made it punishable to sell "an adulterated article," giving a definition of what should be considered an "adulterated article," with certain limits as to the *maximum* or the *minimum* quantity of certain constituents which different articles might contain. Such a "definition" and such "limits" have after considerable study been drawn up by the "Society of Public Analysts." In conclusion I can only express the confident belief that, whether this Bill be so altered and amended as to become a useful measure or not, our discussion of the subject of "Adulteration of Food" here to-night, cannot but be of great value in drawing the attention of the public to a question which most nearly and vitally affects the good of the community.

A discussion followed, in which Mr. Holborn, Mr. Sewell White, Dr. Muter, Mr. Helm, Dr. Bartlett, Dr. Dupré, and others took part. The question brought forward related mainly to the difficulties which had been found to arise before magistrates in deciding between conflicting analytical testimony. One or two speakers treated the Bill from

a trade point of view, dwelling on the hardship to small tradesmen, which they believed had sometimes arisen during the working of the Act at present in operation.

The subject of the nomination of a supreme court of appeal for disputed cases of analysis was also freely discussed; one gentleman arguing that such a body or institution should, to insure impartiality, be appointed without consultation of persons holding appointments under the Act; and others that the Society of Public Analysts itself should have a prominent voice in the matter.

Decided opinions were expressed against the appointment of medical officers of health as Public Analysts, on the ground that the successful pursuit of food examination required more time than such officers were enabled to devote to its practice, consistently with a proper performance of their other important duties.

The correctness of a so-called classification of evidence compiled and issued in the interests of the Tea trade, having been impugned by Dr. Bartlett, Mr. Holborn, who announced himself as a joint author of the work in question, spoke to its absolute accuracy, which was, however, disputed by Mr. Wigner.

Votes of thanks to the Chairman and to Mr. Wigner concluded the meeting.

CORRESPONDENCE.

CHAMELEON BAROMETER.

To the Editor of the Chemical News.

SIR.—In my first communication upon this subject (see CHEMICAL NEWS, vol. xxxi., p. 88) I stated that the actual temperature had apparently no effect upon the colour of the paper. Since then I have had reason to change my opinion. During the late severe weather I have had better opportunities of studying the behaviour during frost, and I have observed that, though the paper will remain red in summer for a difference of 3° between the thermometers, in very cold weather it is only red when that difference sinks to 0°, or perhaps 0.5°. This seems to agree with the fact that cold air cannot dissolve so much aqueous vapour as warm air.—I am, &c.,

A. PERCY SMITH.

Rugby, March 6, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 5, February 1, 1875.

M. Becquerel has presented to the Academy a copy of his recent work "On Physico-Chemical Forces, and on their Intervention in Natural Phenomena." In this work he gives a historical summary of his researches on the development of electricity by chemical action.

On Magnetism.—M. J. M. Gaugain.—M. Elias, in *Poggendorff's Annalen*, lxii., p. 249, refers to a process of magnetisation which consists in heating a bar of iron to redness, suspending it from a pole of an electro-magnet, and letting it cool in that position. "This method," he continues, "as everyone knows, is without results." The author has tried this process, and considers that in certain cases it proves successful.

Magnetic Anomaly of Sesquioxide of Iron, Prepared from Meteoric Iron.—L. Smith.—Hydrated artificial sesquioxide of iron, dried at a high temperature,

is slightly attracted by the magnet, but loses this property if heated to redness, or beyond. Sesquioxide of iron, prepared in the ordinary manner from a solution of meteoric iron, and dried at a low temperature, behaves like ordinary oxide, with this difference—that it becomes decidedly magnetic on being heated from 400° to redness. Sesquioxide of ordinary iron, mixed with nickel or cobalt, or with both, manifests magnetic properties identical with those of ordinary iron. Sesquioxide of iron prepared from meteoric iron, entirely free from traces of nickel or cobalt, behaves with the magnet like the ordinary sesquioxide. Sesquioxide produced from a solution of iron mixed with copper behaves like oxide prepared from meteoric iron. Sesquioxide of iron, mixed with manganese, gold, platinum, zinc, or cadmium does not differ in its magnetic reactions from pure iron.

Artificial Reproduction of Monazite and Xenotime.—M. F. Radominski.

Pulverisation of Manures, and on the Best Means of Increasing the Fertility of Soils.—M. Menier.—The author recommends the use of manures in impalpable powder.

On Magnetism.—M. A. Tréve.—Referring to the discovery of De la Rive, that if in Ruhmkorff's great electro-magnet the current is closed between the two poles there is neither spark nor sound, but on opening it there is a detonation almost like a pistol shot, the author states that the phenomenon announced by De la Rive is equally produced in the sphere of attraction of either pole; that it is not inherent in an inductor current alone, but that the current of any independent battery, interrupted in this sphere of attraction, gives rise to the same effects, and that the extra current augments the tension really and considerably.

On Hydrogenised Iron.—M. L. Cailletet.—On decomposing with the battery a solution of neutral chloride of iron mixed with sal-ammoniac, we obtain at the negative pole metallic iron in the form of mamillary masses, brilliant, brittle, and hard enough to scratch glass. This iron, after being washed, disengages, either under water or any other liquid, bubbles of a gas, which is pure hydrogen. In the air the iron only loses a part of the hydrogen which it contains. A specimen weighing 0.9 grm. kept for fifteen days in an open tube gave, when heated, 18 c.c. of gas, or more than half of what it contained at the moment of its preparation. If a fragment of the iron is placed under a test-tube filled with water heated to 60° or 70° , the escape of gas becomes tumultuous. 1 volume of iron contains from 248 to 235 volumes of gas. If a piece of hydrogenised iron is approached to a burning body, the disengaged hydrogen burns, and the metal is surrounded with a light flame, like that of a match steeped in alcohol. When iron has lost its hydrogen by heat, it cannot be resumed. If we use as the negative electrode of a voltmeter a plate of galvanic iron previously heated, the hydrogen of the decomposed water escapes in abundance along the metal, but not any of it is taken up. Galvanic iron may be readily powdered, but after being heated it re-assumes a certain degree of ductility. Hydrogen when associated with iron imparts to it a considerable coercitive force.

Molecular Equilibrium of Solutions of Chrome Alum.—M. Lecoq de Boisbandran.—A controversial reply to the paper of M. Gernez (*Comptes Rendus*, p. 1332, December 7, 1874).

Perbromide of Bromated Acetylen.—M. E. Bourgoin.—Already noticed.

Amelioration of the Quality of Beet-Root.—M. Ch. Viollette.—The author recommends attempts to improve the beet-root by the careful selection of seed.

Special Butyric Fermentation.—P. Schützenberger.—If at a temperature of 20° to 30° , the direct rays of the sun being excluded, stems of *Elodea Canadensis* are left in a solution of sugar, after the lapse of a few hours a

part of the sugar is inverted, a mixture of hydrogen and carbonic acid is given off, and butyric acid is formed in notable quantities.

Second Note on the Combustion of Detonating Mixtures.—M. Neyreneuf.—The author finds that if detonating gaseous mixtures are exploded in test-tubes, previously coated with paraffin, definite figures are traced in the fatty matter.

Les Mondes, Revue Hebdomadaire des Sciences.
No. 5, February 4, 1875.

New Arrangement for Producing the Electric Light.—M. Wilde.—A Mr. Ladyguine has overcome all the difficulties encountered in the production of the electric light, and has rendered its general use practicable. It has long been known that the carbon electric light is not due to a direct luminous effect of the electric current, but merely to the property which this current possesses of heating the conductors which it traverses, and that with the greater intensity the more resistance they oppose to its passage. The intensity of the ordinary electric light (with carbon points) arises from the circumstance that the stratum of air, a bad conductor, which is found between the two charcoal points, is heated to an excessive degree by the passage of the electric current, and thus produces indirectly the combustion of the coke or charcoal electrodes, heated to whiteness. It has also long been known that solid bodies may also be heated to whiteness without the presence of gaseous matter. Thus, slender platinum wires have often been heated by the current. The light from this source is more fixed and constant than that of the luminous arc between the carbon points; but it is too feeble and too costly, whilst attempts to increase its intensity generally result in the fusion of the platinum. M. Ladyguine replaces the wire by slender rods of carbon (coke) hermetically sealed in a glass receiver, from which the oxygen has been removed.

Electro-Magnet with Concentric Tubes.—M. Camacho.—The principle of the apparatus is that of tubular magnets. A central iron tube is surrounded with a helix of copper wire furnished with an insulating coating. Around it is another iron tube with its helix, and then a third, likewise with a helix. The effect is said to be beyond all comparison greater than that of any previously devised arrangement.

Photographic Properties of the Salts of Vanadium.—M. J. Gibbons finds that a sheet of paper steeped in a solution of a vanadic salt, and dried, gives, on exposure to the light, a good image under the influence of uranic salts.

Experiments on the Effects of Magnetism upon an Electric Discharge passing through a Rarefied Gas in the direction of the Produced Axis of the Magnet.—MM A. de la Rive and E. Sarasin.—Not adapted for abstraction.

Electric Discharge in the Aurora Borealis, and the Spectrum of the same Phenomenon.—M. Selim Menström.—The pale lights seen over the summits of the mountains of Spitzbergen and Lapland are of the same nature as the aurora. Similar phenomena observed in other regions prove that electric discharges of the same nature as the aurora may occur elsewhere besides in the arctic regions. The spectroscopy is the safest means of determining the nature of these phenomena in doubtful cases. In the spectrum of the aurora there are nine rays, which probably agree with the lines given by the component gases of the atmosphere. The spectrum of the aurora may be resolved into three different types.

Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, No. 14, February, 1875.

Reproduction, by Chemical Methods, of Useful Natural Organic Substances.—M. de Luynes.—A lecture on the recent artificial production of alizarin, vanillin, &c.

Report on the Improvements Recently Effected by Private Industry in the Manufacture of Porcelain: Present State of the Manufacture in Limoges.—M. Salvétat.—A lengthy paper; not suitable for abstraction.

Reimann's Farber Zeitung, No. 2, 1875.

This number contains a continuation of the essay on the removal of "burls" from woollen goods.

A Hungarian professor has "discovered" the extraction of indigo from wood—a process far from uncommon in Thüringen during the great blockade of the Continent at the outset of the present century.

Dr. E. Jacobsen has invented a kind of pencils or crayons made of methyl-violet, thickened with gum, and fixed in a wooden case. The writing appears like that of a lead pencil, but when moistened becomes a bright violet, and will yield a perfect press-copy, even when several months old.

There are receipts for a crimson, a chamois, a ponceau, and a blue on knitting-yarns; a rose for silks; a dark blue for half-woollen doubles; a "pott-green" for cotton; and a silver-grey for mixed garments.

Aniline Black.—To prevent aniline black, fixed by printing, from subsequently turning green, R. Glanzmann proposes to fix previously prepared aniline black upon the fibre by means of albumen. He recommends the following proportions:—100 grms. aniline, 400 grms. of bichromate of potash, and 2 kilos. of water. Boil for three hours, wash by decantation, drain on a filter till the moist mass weighs 300 grms.

M. Reimann points out that he introduced a similar procedure four years ago (see No. 7, 1871).

No. 3, 1875.

This number contains a paper, issued by the Berlin dyers, on the decay of the tinctorial arts in that city, which was formerly supreme in woollen yarns.

There is a continuation of the essay on the removal of "burls" by chemical means; a receipt for dyeing cloth a Russian green, and for chrome-orange on cotton yarns.

MISCELLANEOUS.

The Faraday Lecture.—We have pleasure in announcing that the Fellows of the Chemical Society will dine together on Friday, the 19th inst., being the day following that on which the Faraday Lecture will be delivered by Professor A. W. Hofmann, who will be the guest of the Fellows on that occasion. The charge for tickets will be one guinea.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in desilvering lead. Joseph Alexander Cicognani, merchant, Great Winchester Street, London. (A communication from Baron Andrea Podesta, Genoa, Italy.) May 21, 1874.—No. 1800.—In this Provisional Specification the process of desilvering lead is divided into seven stages:—1. Melting the lead in pots and skimming. 2. Introducing zinc into the pot and skimming off the argentiferous zinc. 3. Heating the desilvered lead in a reverberatory furnace to remove the remaining zinc. 4. Roasting the zinc scum on the inclined sole of a furnace to allow some of the lead to run out. 5. Treating the zinc scum to transfer its silver to a comparatively small quantity of lead. 6. Cupelling the rich lead of stage 5. 7. Treating the slag produced in stage 5.

An improved process for preparing hydrate of magnesia. William Edward Newton, civil engineer, Chancery Lane, Middlesex. (A communication from Charles H. Phillips, New York, U.S.A.) May 21, 1874.—No. 1810. The object of this invention is to produce an improved medicinal compound, consisting of a hydrate of magnesia, which the inventor denominates "milk of magnesia." This is effected by causing a solution of ammonia to act on and decompose any suitable soluble salt or compound of magnesia, so as to precipitate all the magnesia in the form of a hydrate.

Improvements in treating bones, horn-piths, phosphates, and other materials in order to obtain products therefrom, and in the apparatus or means employed therefor. Andrew George Hunter, Flint, North Wales. May 21, 1874.—No. 1811. The features of novelty which

constitute this invention are—First. The system of recovering hydrochloric acid from solutions containing phosphates or phosphoric acid by evaporation or condensation. Second. The use of vertical or other retorts provided with valves, whereby continuous distillation of phosphorus, charging and discharging may be carried on without permitting access of air to the interior of the retorts when at work. Third. Causing volatilised phosphoric acid to come in intimate contact with carbon at a temperature sufficiently high as to deoxidise the acid. Fourth. The use of gelatinous silica for the purposes described. Fifth. The production of gelatinous silica and phosphate of soda or potash from silicates of soda or potash by precipitation by means of phosphoric acid. Sixth. Separating phosphorus from phosphate of soda or potash by distilling the said phosphates mixed with silica, and recovering silicate of soda or potash available for producing gelatinous silica. Seventh. The combined process whereby the constituents of bones or horn-piths may be obtained as glue or gelatine, fertilisers, sulphate of lime, and phosphorus. Eighth. The combined process of decomposing phosphate of lime, soda, or potash, and of the subsequent recovery of the said soda or potash. Ninth. The employment of precipitated tribasic phosphate of lime for the production of phosphorus by distillation with silica. Tenth. The employment of self-acting valves between the distilling retorts and condensers to prevent back pressure or back flow therefrom to the retorts. Eleventh. The employment of self-acting valves between the several retorts to prevent back pressure or back flow from one retort to the other, and to enable one retort of a series to be opened at pleasure, without back flow from the others.

Improved means or method of clarifying sewage and impure waters from dye-works, bleach-works, tanneries, mills, and manufactories, and rendering the precipitate or "sludge" combustible and useful as fuel. Rupert Goodall, machinery agent, Armley, Leeds, York. May 23, 1874.—No. 1826. This consists, first, in the employment of certain chemicals to precipitate the solid matter; secondly, in the employment of lime and chemicals; and, thirdly, in the employment of the chemical precipitants, lime, and small coal, to render the precipitate available for fuel.

A new or improved indelible ink. John Garrett Tongue, of the firm of Tongue and Birkbeck, patent agents and engineers, Southampton Buildings, Chancery Lane, Middlesex. (A communication from Pierre Auguste Gaffard, manufacturing chemist, Paris.) May 25, 1874.—No. 1839. This invention relates to the manufacture of a new indelible ink. The process employed to obtain this ink is very simple. It consists of diluting well separated carbon with a solution of an alkaline silicate, such as silicate of potash, soda, or other silicate. The following are the proportions of materials, which in practice may vary according to the nature of the agents employed, the invention not being confined to the said proportions:—Carbon or lamp-black from wax candles, lamps, or other source, 1 part by weight; silicate of potash (of a syrupy consistency), 12 parts by weight; ammoniacal liquid, 1 part by weight; distilled water, 38 parts by weight.

NOTES AND QUERIES.

Glue and Size.—I shall be obliged if you can inform me whether there is a good work published on glue- and size-making from bones, and where I can obtain it.—WILLIAM R. EARP.

Ultramarine.—You would greatly oblige me by giving me a list of the English ultramarine manufacturers, or by giving me advice where I could get such a list.—A. O.

Welding Iron.—Having had occasion to melt some white metal over our smith's fire this morning in a wrought-iron ladle, it was afterwards found impossible for him to weld two pieces of wrought-iron together, heated in the same fire to a welding heat (though there was none of the metal let fall into the fire), for after being beat together into their proper form they broke across in the place of welding, showing a black oxidised surface; and when looked at with a small lens it was found that they had not joined together in one single place, though the iron was an inch square. Now, Sir, I should feel very much obliged if either you or any of the correspondents of the CHEMICAL NEWS could give me the reason or *rationale* of such an occurrence. If lead or zinc is melted over his (the smith's) fire, the same occurrence takes place, and before he can go on with his work he has always to take away the old fire, and make a new one.—HENRY LEEMING.

MEETINGS FOR THE WEEK.

SATURDAY, March 13th.—Physical, 3.

MONDAY, 15th.—Medical, 8.

— London Institution, 5.

TUESDAY 16th.—Civil Engineers, 8.

— Zoological, 8.30.

— Royal Institution, 3. Alfred H. Garrod, Esq., "On Animal Locomotion."

WEDNESDAY, 17th.—Meteorological, 7.

— Society of Arts, 8.

THURSDAY, 18th.—Royal, 8.30.

— Royal Institution, 3. Professor Tyndall, "On Subjects Connected with Electricity."

— Philosophical Club, 6.

— Chemical, 8.

FRIDAY, 19th.—Royal Institution, 8. Weekly Evening Meeting. Dr. R. Liebreich, "On the Real and Ideal in Portraiture." 9.

— Philosophical, 8.

SATURDAY 20th.—Royal Institution, 3. Prof. W. K. Clifford, "On the General Features of the History of Science."

THE CHEMICAL NEWS.

VOL. XXXI. No. 799.

ON SOME REACTIONS OF METALLIC SODIUM ON CHLOROFORM.

By SERGIUS KERN, St. Petersburg.

THE following is the result of my researches on some interesting reactions of sodium and chloroform. The chloroform for the experiments was prepared by heating $\text{CCl}_3\text{CO.OH}$ (trichloroacetic acid) according to the following equation:— $\text{CCl}_3\text{CO.OH} = \text{CCl}_3\text{H} + \text{CO}_2$.

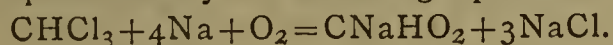
1. In a strong test-tube 1 grm. of chloroform and a small quantity of water were poured, whereupon 3 grms. of metallic sodium were then added. A strong reaction with sparks and fire was the result, and all the interior part of the tube was covered with finely divided charcoal; in the lower part, meanwhile, a white substance was received, which proved to be a mixture of sodium chloride (NaCl) and caustic soda (HNaO). The reaction which took place was accompanied by the evolution of hydric chloride (HCl), and may be represented:—



It must be mentioned here that this experiment must be made very carefully, because from the high temperature of the reaction the tube often breaks.

2. Some chloroform and metallic sodium were left for brown precipitate was received, which was dried over six or seven days in a loosely corked test-tube. A light sulphuric acid under a glass bell. The brown semi-crystalline powder obtained is whitened on exposure to the action of air. The analysis proved it to be a sodium salt of formic acid (NaCHO_2), which gave with sulphuric acid free formic acid (HCHO_2).

The reaction is a very complicated one which I am now studying. I presume that the metallic sodium firstly is transformed into caustic soda by the oxygen of the air, and acts in this state on chloroform; the final reaction must be represented by the following equation:—



LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE
CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

(Continued from page 112).

LECTURE XI.

THE descriptions of the forms of the tetragonal system was succeeded by a discussion, on the part of the lecturer, of a law to which only slight allusion had been hitherto made, which regulates certain defalcations in the number of the faces of a form that are occasionally presented by crystals. Planes of symmetry have been alluded to as potential, but not necessarily actual planes of symmetry, and the scrutiny of crystalline forms has led to the result that in such crystals the presence of some and the absence of other faces of a form may be traced to planes that in a complete form would be planes of symmetry, having this symmetrical character, as it were, in abeyance; and, further, that this is the case invariably in a similar way with regard to conformable planes of symmetry. Such partially developed forms Mr. Maskelyne designated as mero-symmetrical forms.

They are of two distinct kinds, similar, however, in this respect—that the extant faces represent one half the

absent faces, the other half of those belonging to the complete form, and that they are absent or extant in alternation. The extant faces may all belong to different normals—that is to say, each normal of the form may be represented by one extant face, or the extant faces may be those belonging to one-half of the normals, each alternate normal thus presenting its pair of parallel faces on the crystal, the remaining normals being obliterated; and, further, a kind of mero-symmetry occurs, in which the crystal presents but one quarter of the faces of a form, as where alternate normals only are extant, and each of these only carrying a single face.

The varieties of mero-symmetry that a crystal may present will obviously be in some cases very numerous, but they are readily classified, and symbols found for them, when the particular planes of symmetry that remain such in a crystal are recognised, and when we know whether the crystal is centro-symmetrical or not. One variety of mero-symmetry which presents some interest from the physical point of view is that known as hemimorphism, in which a single plane of symmetry unique in its kind ceases to be symmetrical, while the form also is not symmetrical to a centre, all the faces on one side of this plane being, therefore, absent.

The lecturer proceeded to sketch the character of the mero-symmetrical forms of the three systems already considered, viz., the clino-rhombic, the ortho-rhombic, and the tetragonal systems of crystallography.

ON THE MANUFACTURE OF CAUSTIC SODA.*

By JOHN MORRISON, F.C.S.

(Continued from page 104.)

AND now for manufacturing details. No special proportion of slack is usually adopted for the making of the black-ash from which caustic soda is to be manufactured. 3 cwts. salt cake, with a shovelful or two of fished salts, are first laid down in front of the mixing-bed door, then a quantity of lime mud (which varies from time to time to keep pace with its production) say on an average 4 cwts., and finally a proportion of slack, more or less, according to quality, but usually about $1\frac{3}{4}$ cwts. In a convenient corner a supply of limestone is from time to time thrown down, and from this the mixer throws on to the top of the charge when in the furnace as much as experience proves will ensure with proper working a satisfactory ball.

Balling with limestone is less laborious than in the case of chalk, the latter being the most refractory, and more work is consequently got out per furnace in Lancashire than here. Fourteen to sixteen balls per twelve hours' shift is the usual produce, when as above a proportion of lime mud is substituted for an equivalent amount of "stones;" but if the latter alone be used, this margin can be considerably increased. Thirty-four balls are then a good double shift's work, though there are plenty of men in Lancashire who have drawn twenty, and some who have turned out twenty-four respectable balls in a single shift.

Lancashire balls are not nearly so regular in appearance as those produced in this district, and are, I think, also a little less easily lixiviable.

It is quite as desirable that the vat liquors going to the causticiser should be settled as those going to the salting down pan, and though in many works this department receives very little attention, owing to a current belief that in the operation pan the lime will carry down with it everything that previous settling could possibly have removed, I am strongly of opinion that good settling before each of the three stages of causticising, evaporating, and finishing, is the *sine qua non* of irreproachable caustic.

After settling comes causticising. The vat liquor is reduced to $16-18^\circ \text{T}$. with water heated to or near the boiling-point, and treated gradually with

* A Paper read before the Newcastle-upon-Tyne, Chemical Society

reshly burnt lime, which is thrown into an iron cage or basket of any suitable form, fixed within the vessel—with the object of retaining all stones—while the liquor is maintained in a state of brisk agitation. The experienced workman can tell with a considerable degree of accuracy, by the boil, colour, and other indications, when the liquor is thoroughly causticised; and the operation is complete when no effervescence is produced on the addition to a filtered sample of the batch of a few drops of dilute sulphuric or hydrochloric acid. The charge may be run off at once to a separate settling vessel, or may be settled in the operation pan. In the latter case the carbonate lime subsides in the course of half an hour sufficiently to admit of commencing the withdrawal—by means of a drop or swivel pipe—of the clear supernatant liquor into a well, whence it is removed to the causticised liquor settlers. When as much liquor as possible has been drawn off, a fresh quantity of vat liquor and water is run in for the completion of a second batch (which, I may remark, does not take quite as much lime as the former), and when this one has in its turn been removed, the agitator is re-started, and a quantity of water run into the pan, and the whole being mixed and sludged off on to the filtering bed, the pan is ready for another charge.

As soon as the filter has received a batch, the vacuum pump is set in motion, and first the air and then—as rapidly as it collects—the filtrate is withdrawn from underneath the bed. Very soon cracks appear on the surface of the mud. These are immediately obliterated with a wooden rake, while a supply of water is run on and worked well into the mud, with the object of removing as much soda as possible. But in three or four hours the magma has become very firm, and as much of the liquor removed as could be induced to leave it, so that the vacuum pump may be stopped, and the liquor which is now in the receiving vessel, be run into the operation pan to assist in the reduction of the vat liquor to the causticising strength.

In the settlers the causticised liquor deposits any little lime it may have previously retained, and when perfectly “bright” may be removed as required to the weak pans. Two of these, as I have explained, are attached to each black-ash furnace, the back one being a little higher than its neighbour. Into the former, which serves as a feeder to the other, the liquor is transferred from the settlers, and though in it only a state of incipient ebullition is usually attained, still by increasing the amount of effective work performed by its companion, it is of material service. In the front weak pans the liquor attains a strength of 35° to 40° T. cold, and from them the strong pans are replenished by means of a 2 or 3 inch pipe screwed on to the outer end of the front weak pans, and the free end of which—provided with a cock—projects over the side of the back strong pans. The latter, as in the case of the back weak pans, serve as feeders to their less fortunate brethren who have the lion’s share of the duties. In them so furiously indeed does the liquor boil that “splash boards” are necessary. These are commonly of sheet iron (about nine inches deep), passing right round, and clasping the pan flanges by means of several brackets rivetted to them for the purpose.

A constant stream runs into these pans regulated to keep up the supply as rapidly as the evaporation proceeds, and when a sp. gr. denoted by about 60° T. hot is arrived at, a few pounds of nitre are in some works added, with the object of keeping the pan free from scale and aiding—as the workmen suppose—in the deposition of the “salts.” It of course also assists in the oxidation of the sulphides. The evaporation is continued till the liquor reaches 70° to 72° T. if for 60 per cent caustic, or 80° to 85° if for 70 per cent; and then the fires are allowed to burn down, and the pans consequently to cool. After the lapse of an hour or two the supernatant liquor is drawn off through a swivel pipe into shallow settlers, and the salts remaining on the pan bottom extracted and placed on a small drainer (fixed conveniently for the purpose) by

means of a perforated shovel, and when the liquor has thoroughly drained from them they are removed for use in the black-ash furnaces. The strong pans are run off about once in twenty-four to thirty hours, and about five of them are necessary to make up one ten-ton pot of finished caustic soda. In the settlers which feed the pots, where we must now suppose the liquor, a small additional quantity of “salts” is deposited, but only sufficient to necessitate a weekly or fortnightly cleansing. The deposit from them, however, is of a sloppy and undrainable character, and contains sulphides. In some works these pot settlers are dispensed with, but when comparative immunity from carbonate is an object, they are absolutely essential. When they are not in use, of course more settling time must be allowed the strong pans—say six or eight hours.

The pots on receiving a sufficient supply of liquor from their settlers are immediately fired, and any remaining “salts” which may separate until the liquor reaches about 90° T. are re-dissolved as the latter becomes more concentrated. The pots are used for finishing in rotation, and into the one selected for this operation fresh supplies of liquor from one or more adjoining pots, and of a strength ranging from 120° to 150° T., are transferred by baling.

But it just occurs to me that I have omitted to remark, what, however, has been probably evident to most of you, that the several levels from that of the causticised liquor settlers downwards to the caustic pots are so arranged that the liquor can be advanced from stage to stage by ordinary gravitation. Where this arrangement throughout is impossible, partial recourse must be had to hand-baling, which is a tedious and slovenly operation.

The liquor from the pot settlers boils freely at about 250° F., throwing off a semi-transparent straw-coloured foam, which deposits in the eddies—in little island-like masses or tufts—a light and loose froth. This froth consists of “salts,” principally carbonate of soda, and is removed by means of a perforated skimmer if the production of 70 per cent caustic soda be the object, but allowed to take care of itself if that of 60 per cent is the intention. At this early stage, the evolution of ammonia—chiefly the effect of the addition of nitre to the boat pan batches—becomes very distinctly perceptible, and with the exhaustion only of the reagent does the characteristic odour vanish. A quantity of “salts,” too, separate until the liquor approaches the sp. gr. represented by 85° to 90° T., about which strength, however, they begin to grow gelatinous, and soon re-dissolve entirely. But occasionally when a high-strengthed and pure caustic is required, these salts are removed, the pot being of course cooled down, and the liquor settled to admit of this. And now the liquor which has become deeper in colour, boils at about 300° F., and commences to discharge a black looking scum containing much sulphide; and gradually, as it becomes more concentrated, it assumes a more viscous or treacly condition, while if it be bad or technically “sulphury” it begins to exhibit strong objections to remaining within bounds, so that the men have to whip or flip the surface in a peculiar manner with a fishing shovel to keep down the foam as it is termed. If, however, you are not looking, they will, to save a little of this trouble, pour in a libation of oil from a convenient “feeder,” or failing that, impart a dose of furnace grease. When the batch is in this perverse condition it also ill brooks the addition of fresh liquor, especially if weak and unsettled, so that great caution and long suffering are very necessary on the part of the workmen to prevent its elopement. It will submit to be coaxed, but resolutely declines being driven; and when very evilly disposed, strong measures are extremely dangerous, and must be undertaken in the full consciousness of the risk of its suddenly, and without troubling you with any preliminary warning, bolting out of the pot with something akin to explosive violence; a performance better viewed from a distance, but best witnessed not at all, for it produces an awful mess, and

renders you nervous for the rest of the day. When this "sulphury" liquor is very strong the foam is much more sluggish than at earlier stages, and from it separates a scummy sort of crust, or perhaps more correctly a crusty kind of scum, which readily adheres to any tool brought into contact with it, and collects abundantly around the sides of the pot. The administration of homœopathic doses of nitre, sprinkled over the surface is the plan adopted to "cut away" this excrescence, and restore the liquor to its pristine state; but this stupid condition is a great nuisance while it lasts, for it renders gentle firing absolutely necessary, so that the completion of the batch is delayed. When it reaches 400° F. the liquor is extremely concentrated, thick and dark, and has almost ceased to boil or give off steam; what little steam is evolved now, however, carries with it fine particles of caustic soda, which cause unpleasant irritation to exposed portions of the skin. The sensations are similar in kind to what would ensue on brushing one's cheeks with a bunch of rather vigorous nettles, but they are *facile princeps* in degree. The pots though, do not all "bite" with equal severity, and the condition of the atmosphere would almost seem to have something to do with the business, for it is in damp foggy weather that the sensations are most exasperating. At a temperature of 500° F. the "boil" has resolved itself into a gentle effervescent-like motion, extending round the edges of the pot. And now small quantities of a pungent irritating fume are emitted, with carbonaceous matter, while a reddish deposit or "sublime" forms round the pot rim, containing sulphide and some carbonate. Finally the boil ceases altogether, and floating on the surface of the batch a black-looking froth, intermixed with a number of more solid-looking particles, commends itself to your notice. To call this a scum would be almost too calumnious, for when a little is taken on a scoop, and closely examined, it really presents a very respectable appearance, exhibiting the metallic lustre of graphite in a finely divided condition. At this stage the pot is covered with a sheet iron lid provided with a small opening at one side, and the fire being simultaneously urged as strongly as possible, a portion of the graphite slowly consumes. When the temperature is sufficiently elevated, a point the workmen easily ascertain by experience, two courses are open for the complete oxidation of the sulphides—one consisting in the introduction of nitre, the other in that of the current of atmospheric air. In the former case, the nitre is introduced (a hand-scoopful at a time) through the opening. Its action is at first very energetic, and if the pot be very hot, it deflagrates as soon as it touches the surface of the batch, flooding the latter with a fine brisk effervescence, which quickly subsides, and permits of a further addition of the reagent. At the commencement, the nitre may be introduced pretty rapidly, but as the pot approaches "clearness," fresh additions must be made with extreme caution, for fear of overdoing; and to this end it is necessary, every now and then, to solidify a small sample by pouring over a clean shovel, and to apply to it a drop or two of solution of acetate lead; and when the film of caustic presents, after such an application, just a faint darkening by transmitted light, sufficient nitre has been added, for, as the workmen express it, the fire will "clear the rest." In the case of oxidation by a current of air, the latter is generated by an ordinary blowing engine with short stroke for low pressure; and it is very essential, particularly when water is the lubricant adopted for the air cylinder, that the latter be provided with a receiver, to which may be attached the safety-valve, for the complete interception of the water which would otherwise pass into the pot, with obvious consequences. The engine usually adopted in Lancashire is double acting, and if for blowing not more than two or three pots at once, has a 12-inch air cylinder and a 12-inch stroke. The main delivery pipe may be 2½ inches, and is provided with a reducing tee branch for each pot, and a waste cock. When a pot is ready for blowing, a

strong 1½ inch wrought-iron pipe, terminating at its lower end in a perforated ring of about 18 inches in diameter, or occasionally in a tee of about the same length, is plunged into it till the ring or tee rests on the bottom; and the upper end, to which an india-rubber pipe fitted with a coupling screw is secured, is then attached to one of the branches of the air pipe. The only precaution necessary on now starting the engine is to remove any stray water from the pipes by opening the waste cock for a few seconds, and on closing it, communication may be immediately opened with the pot. The fused mass is soon in violent commotion, its temperature gradually rising till, after the lapse of two or three hours, it reaches redness. If the liquor has been good, and the boat-pans nitred, three or four hours' blowing will be sufficient; but if no nitre has been employed in the pans, about eight hours will be requisite. In the case, however, of inferior liquor, resulting from bad black-ash or careless lixiviation, the operation may occupy a much longer time, cases having occurred when thirty-six hours' blowing have been necessary. The same cautions as to over-doing apply to blowing as in the case of nitreing. Occasionally the pots become clear quite suddenly, and from this cause, but more frequently from the negligence of the men, they are "over-done," and rendered green. In this case the usual course is to throw in a small piece of sulphur, which brings the batch once more into condition; or the same result may be secured by the cautious introduction of a scoopful or two of liquor from a neighbouring pot.

(To be continued).

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, January 12, 1875.

R. ANGUS SMITH, Ph.D., F.R.S., &c., Vice-President, in the Chair.

E. W. BINNEY, F.R.S., V.P., said that at the present time great attention was being paid to the sewerage of towns. Our Corporation had brought before the public a plan for dealing with the flood waters of the Medlock, and it is generally understood that Parliament will attempt to do something to prevent the further fouling of streams. Both Parliament and Corporate bodies have been long in moving in this matter, and the doing of that which should have been done 30 years ago will now be a matter of the greatest difficulty. In 1840 the Irwell approached Salford in so pure state that numerous fish were seen in its waters near the present Peel Park, but after Manchester and Salford sewers had entered it none were to be met with in it at Cornbrook. Fish were also at that time in the Medlock above Pin Mill Bridge.

In order to show how long a time authorities take to consider before they trouble themselves with action he brought a Report on the Streams of Manchester, published by Dr. Lyon Playfair in the Health of Towns Commission in 1844. After describing the geology, watershedings, and streams of the district, the report proceeds as follows:—"When the boroughs of Manchester and Salford were not so thickly populated as at present and the surface of the soil was in its primeval condition, without any irregularities arising from artificial excavations, since caused by the making of bricks and for other economical purposes, the sites of the towns, from their undulating surfaces alone, would possess good top drainage into the streams and rivulets before mentioned. Some little obstruction to the drainage might arise from the rows of cottages which are generally built nearly at right angles to the inclinations of the surface of the land; still the irregularities produced by the hand of man have doubtless been in part rectified by public sewerage into the water-courses above

alluded to, and had such water-courses been allowed to pass unimpeded through the towns, although they might have caused some nuisances, still they would not be in anything like the filthy condition which they are now, owing to the weirs and dams marked X in map appended to this report that stop their courses and form so many cesspools, allowing some of the top waters certainly to flow along but collecting all the heavier particles, and thus continually generating the most offensive effluvia.

"The River Irwell, after having by its tributaries afforded drainage and sewage to the towns of Bolton, Heywood, Bury, Rochdale, Radcliffe, and numerous other places, and having been pent up in countless reservoirs and dams for manufacturing purposes, approaches Salford by the Adelphi in a pretty tolerable condition as to purity, inasmuch as small fish live in its waters—a very rare circumstance in any other of the streams hereinafter mentioned. At the Adelphi is a high weir built quite across the river. After passing this impediment the stream is polluted by numerous works upon its banks and the contents of the sewers of the eastern and south-eastern parts of Salford, until it receives the waters of the Irk at Hunt's Bank in a much worse condition than its own—in fact, as filthy as water can well be; thence the river flows sluggishly along the western part of Manchester to Hulme, where it receives a portion of the waters of the Medlock and Shooter's Brook (a part of this being kept in the Bridgewater Canal) charged with the contents of the sewers of the eastern and southern parts of Manchester; it is then stopped at Throstle Nest by a dam across its stream. For many miles in its course towards Runcorn it emits offensive smells, and bubbles of light carburetted hydrogen gas rise to its surface.

"The Irk approaches Manchester from Blackley. It, like the Irwell, is anything but a pure stream to begin with. After being dammed up at Messrs. Appleton's paper mills, Mr. Hartley's dyeworks, Mrs. Crompton's paper mill, and Messrs. Appleton's upper logwood mills, it joins the Moston Brook at Collyhurst. This last-named brook is impeded in its course within a quarter of a mile of its junction by three weirs, namely, at Messrs. Appleton's St. George's logwood mills, Messrs. Dentith and Co.'s chemical works, and a weir not far from the old Rochdale Road at Collyhurst. Proceeding with the Irk:—This river after its junction with the Moston Brook is dammed up at Messrs. Appleton's lower logwood mills and near the Bull's Head Inn in Newtown; and after receiving the refuse from the numerous dyeworks, size manufactories, chemical works, tanneries, skinyards, gas-works, sewers, &c., it is stopped at Messrs. Caistor and Thompson's corn mill at Scotland Bridge and the School Mills in Long Millgate before it reaches the Irwell at Hunt's Bank.

"The Medlock enters the borough at Beswick charged with the refuse of numerous works, and is dammed up by weirs across its course at Messrs. Guest's weir at Beswick, Neck Break weir, the Island Mill weir (a little below which near Fairfield Street it receives some fetid water from a small dam at Cruickshank's Mill), Messrs. Hoyle's weirs in Ardwick, and the weir near Messrs. Wood and Westhead's Mill in Garratt. At this place it receives the water of Shooter's Brook, a filthy little stream as black as ink, which enters Bradford from Newton, and after flowing under Butler Street to New Islington exposed is covered in till it reaches the Medlock at Garratt. This last-named stream, after its junction with Shooter's Brook, passes under Oxford Road along Little Ireland, and is dammed up near Messrs. Birley's Mill in Kenyon Street. It then receives many sewers from the surrounding district and the river Tib in Gaythorn, which runs under the centre of Manchester but is entirely built over, and reaches the Duke of Bridgewater's Canal in as polluted a state as possible; thence some of its water after being employed as a power of winding goods escapes into its old course, which joins the Irwell near Hulme Hall. The waters of the Duke of Bridgewater's Canal are chiefly derived from the Medlock

after it has received the contents of the Manchester sewers, and thus are in as bad a condition as the streams before described.

"Cornbrook enters Ardwick from Gorton, and partly open and partly built over traverses Ardwick, Chorlton-upon-Medlock, Greenheys, Hulme, and Cornbrook, at which last mentioned place it reaches the Irwell in as polluted a state as any of the other streams.

"Besides the streams before described I may mention a little rivulet near Stock Street in Cheetham, which crosses York Street, and after forming several stagnant ponds enters the reservoir in Strangeways Park. There is also another rivulet, which crosses the New Bury Road at Stocks, and flows down to the pool near Strangeways Hall. A third goes from Cheetwood by the end of Broughton Lane; and a fourth by Broughton Grove. All these run into the Irwell. There is also a filthy and stagnant pool of water in front of the houses at Stony Knolls, which excites very little attention among the inhabitants. In Pendleton there is a small stream which, though it has often been presented at the court leets as a nuisance, and is correctly designated "The Black Ditch," remains in just as bad a condition as it ever did. In all the streams above described a number of dead dogs and cats are to be seen in the various states of decomposition, bubbles of gas, light carburetted hydrogen, rise up to the surface, and, although offensive smells are met with at all times, they are by far the most annoying when the barometer has experienced a sudden depression after having been high for a considerable time previously. Sulphuretted hydrogen is the gas which chiefly causes the odour, though doubtless phosphuretted hydrogen assists in some measure."

Such was the condition of the Manchester streams prior to 1844. Immediately after the publication of the Health of Towns Commissioners' Report the sewerage of towns and villages was increased to a great extent, and in nearly all cases the refuse matter was conveyed into the neighbouring streams instead of being utilised in manuring the land as it had been previously employed. No doubt sanitary engineers have been the chief offenders in polluting our waters during the last 30 years, but manufacturers have also done their share by disposing of their refuse matter into the streams. The consequence is that not only are the waters more polluted, but their beds are being continually raised. Single towns on the banks of streams have little power to alter matters, there are so many vested interests to be dealt with. Numerous owners of property have by law what is called a right to foul waters by long user, and it will require strong parliamentary powers to effect any good. The owners of the numerous weirs will have to be compensated prior to such obstructions being removed and allowing the waters of the streams to flow and cut their courses as they once did. Before any great engineering works in the making of tunnels are attempted it is only reasonable that the streams should have a fair chance to cleanse themselves by their own natural flow of water. Manchester and Salford could try what the removal of the weirs at Douglas Mill, the Adelphi, and Throstle Nest would do. Surely such a simple experiment is worth trying before hundreds of thousands of pounds are spent in forming tunnels.

However, let Manchester and Salford spend what money they may, little good will be done unless the pollution of the waters above from their sources downwards to those towns is stopped. No doubt those towns set a bad example in the beginning, but as all the places on the streams are more or less guilty, they ought all to make a fair start together in the race of amending their evil ways of fouling streams and wasting manure.

If once the fecal matter of a large town is diluted with water it is very costly to get it back again either by evaporation or sewage farming. Rival patentees advertise and recommend their respective plans as most efficacious, but at the present time he was not aware of the whole of the sewage waters of any large town in England having been profitably applied for farming purposes.

PROCEEDINGS
OF THE
SOCIETY OF PUBLIC ANALYSTS.

"SALE OF FOOD AND DRUGS BILL, 1875."

IN returning to the subject of this Bill, which has just been reprinted, we have much pleasure in congratulating our readers on the improved form in which it now appears, and we venture, at the same time, modestly to congratulate ourselves upon the removal of the greater part of the blemishes to which we were the first to direct the attention of the Government and the public, and which we have been constant, in season and out of season, in protesting against.

We may mention a few of the defects which have been remedied, and a few of the blots which have been eliminated.

The operation of the Act is now to be extended to Ireland and Scotland.

The definition of the word "food" is now amended in accordance with our suggestion, and instead of "Every article eaten or drunk" it now reads "Every article used for food or drink," thus meeting the hypothetical argument that certain substances in their unprepared state are neither "eaten nor drunk."

Clause 5 (which was Clause 6 in the Draft Bill) is now rendered operative by the excision of the pernicious word "knowingly," and instead of "No person shall *knowingly* sell any article . . . which is not of the nature, substance, and quality of the article demanded," it now stands—"No person shall sell, to the prejudice of the purchaser, any article," &c. The significance and importance of this alteration will be obvious to all who have given any attention to the subject.

The "exceptions" under this clause are reduced in number, and though we confess we still view one of them with some suspicion, it is impossible to over-estimate the importance of the omission of the one which would have rendered "the usage of trade" a justification of adulteration.

In Clause 6 the words "knowingly" and "usage of trade" are alike conspicuous by their absence, the clause simply running—"No person shall sell any compound article of food which is not composed of ingredients in accordance with the demand of the purchaser, under a penalty of twenty pounds."

Clause 7, which refers to "labelling," is rendered clearer by the provision that the label shall be "*distinctly and legibly* written or printed."

In Clause 9, which forbids the abstraction "of any part of an article so as to affect injuriously its quality," &c., the word "knowingly" is also struck out.

In Clause 11 an injustice which would have been perpetrated in compelling an Analyst to examine a sample from a district other than his own, without any payment beyond the fee fixed by the local authorities, is corrected; and if a purchaser in one district takes a sample to the Analyst of another district, the payment for such analysis is to be in accordance with the arrangement made between the two parties to the contract.

In Clause 21, by the adoption of our suggestion to substitute the word "another" for "adjoining," the choice of a magistrate, in a case of reference, is not to be arbitrarily confined to any Analyst in his immediate locality.

Clause 26 is very greatly amended, and now goes far to meet what would have been one of the chief difficulties to be encountered by persons having to put the Act in force. We have before pointed out that though the retailer was to be allowed to go free on production of a written warranty of the purity of the article which he was prosecuted for selling, no provision was made for touching the wholesale dealer signing such warranty. It is now provided that "Every person who shall give a false warranty in writing . . . shall be liable to a penalty of twenty

pounds," and "Any person who shall apply to an article of food . . . a certificate or warranty given in relation to any other article" shall be subject to a like penalty.

It will be seen that these alterations will go far to render the measure a practicable and useful one, and as—when this Bill first saw the light—we felt it our duty to speak of it with almost utter condemnation, it is now with peculiar pleasure that we do justice to the successful endeavours which its authors have made for its improvement. Having said thus much in favour of the Bill as it now stands, we must just say a word or two on some points which appear still capable of improvement.

In the interest of the tradesmen the wording of Clause 3 should be slightly modified. It says that a person shall be punished for "mixing, colouring, staining, or powdering any article of food, with any ingredient of a nature injurious to health." This surely means if the article in its entirety is rendered by such admixture injurious to health, or else a tradesman might be fined for using in the preparation of confectionery minute quantities of flavouring matter, which though certainly if eaten by themselves injurious, and perhaps poisonous, yet in the proportions in which they are used are perfectly innocuous.

By Clause 9 we regret to see that the appointment of Analysts is still to be left optional. We feel strongly the importance of making such appointments compulsory, and we trust that the wisdom of Parliament may even yet correct this defect.

We have already insisted that when an Inspector, employed for the express purpose of purchasing samples for analysis, with money supplied to him for that purpose, shall have so purchased such samples, he should, as a matter of course, take them forthwith to the Analyst; but for some occult reason, which we are unable to fathom, it is still left to him either to take them or otherwise dispose of them, "as he deems it right." We think the absurdity of this only requires to be distinctly pointed out to the House to get it remedied.

We notice that the same extraordinary form of certificate is reprinted with this last edition of the Bill; but this is a matter of detail, and we feel little doubt as to its being arranged satisfactorily.

It remains for us now to await the result of the debate in Committee; but the Government having conceded so much already, we cannot but feel sanguine as to their further action, and it may be that we shall best exert our strength in carefully watching and combatting any reactionary amendments introduced for "trade" purposes, rather than in attempting to exact the concession of *every* point we may deem important, for after all—as we have before reminded our readers—we shall have another opportunity of offering our advice and co-operation when the Bill reaches the "serener atmosphere" of the House of Lords.

THE fourth paper read at the meeting on February 5, 1875, was by A. DUPRÉ, Ph.D., Lecturer on Chemistry at the Westminster Hospital:—

NOTE ON THE NATURAL CONSTITUENTS OF WINE.

Before we can decide whether or no any given article is adulterated, we must necessarily be acquainted with the composition of the article in its pure state. This appears so obvious a truism, that it might seem unnecessary even to mention it, and yet it is one grievously sinned against by many. There is, perhaps, no article of large consumption on which ignorance is so general as it is in relation to wine. Many illustrations of this might easily be brought forward. Wine is the fermented juice of the grape, with such additions only as are essential to the stability or keeping quality of the wine. Such a definition, while it will admit, as unadulterated, the fortified wines of Spain, Portugal, and other southern countries, excludes wines from Germany, France, Hungary, &c., if similarly fortified. In the first case, the addition of a certain

amount of spirit is essential to the stability of the wine, in the second it is not. We may accordingly divide wines into two classes; *natural wines*, the strength of which has not been increased by the addition of spirit and *fortified wines*, the strength of which has been raised by such addition. Some so-called liqueur wines and champagnes might, perhaps, with propriety, be placed into a third class, as being more strictly manufactured than other wines. For our purposes, wine may be regarded as an aqueous solution or mixture of various alcohols, acids, compound ethers, sugar, mineral substances, and so-called extractives, with traces of tannin, essential and other oils, albumenoid substances, and colouring matter.

Alcohols.—Natural wines, as met with in commerce, generally contain from 6 to 12 per cent of absolute ethylic alcohol by weight (7.5 to 14.6 by volume) in volume; in some very rare cases the strength may perhaps come up to 13 per cent (15.8 per cent by volume). With less than 6 per cent a wine is scarcely drinkable, and more than 13 per cent cannot be contained in a natural wine. First, because grape juice rarely contains the requisite amount of sugar for the production of more alcohol; secondly, because such an amount represses, if it does not altogether stop, fermentation; this will to some extent depend on the temperature, and if such fermentation is not then put a stop to altogether, the wine would become vinegar. In fortified or brandied wines, the alcoholic strength of course depends entirely on the operator: it usually ranges from 12 to 22 per cent by weight in volume. Besides this ethylic alcohol, wines always contain traces of some of the higher homologous alcohols, as propylic, butylic, amylic, &c., alcohol. Indeed, the flavour and bouquet of a wine greatly depends on the presence of these alcohols, and they are also perhaps of great influence on its physiological effects. In large brandy distilleries these alcohols are, in a measure, separated from the ethylic alcohol, and constitute the wine fusel oil.

Acids.—All wines contain a greater or less proportion of free acid, and possess therefore an acid reaction. These acids may be conveniently divided into two classes, namely, non-volatile acids, or such as remain in the residue when the wine is evaporated on a water-bath; and volatile acids, or such as are driven off during evaporation. The acids of the first-class, except the trace of succinic acid, are derived from the grape juice, but they are generally present in the wine in a different proportion to that in which they were contained in the must. The chief acids of this class are malic acid and tartaric acid (sometimes part of the tartaric acid is replaced by racemic acid), the former predominating even in pure natural wines, and predominating largely in all fortified wines, in plastered wines often even to the total exclusion of tartaric acid. The volatile acids, and the succinic acid, have all been formed during or after fermentation. In small quantity they are indispensable, being chiefly instrumental in the production of flavour, smell, and bouquet. When present in larger quantity they are, however, objectionable, and give evidence of maltreatment of the wine. The principal of these acids is acetic acid; there are, however, always found small quantities of other homologous acids of this series, as formic acid, propionic acid, butyric acid, &c. In good sound wines the amount of free acid, calculating as if the whole of it consisted of tartaric acid, ranges from 0.3 to 0.6 per cent by weight in volume. In white natural wines not more than about one-fourth of the total acidity should be due to volatile acids. In red wines, as well as in fortified wines, the proportion of volatile acids is usually higher, but should not, even in these, amount to more than about one-third of the total acidity.

Aldehyds.—Many Greek wines contain an appreciable amount of ordinary acet-aldehyd, the same wine being usually characterised by a very high proportion of volatile acid. Besides, in Greek wines, I have met with aldehyd in one sample only of Sauternes and in one of Rhine wine. In both instances the bottles of wine had purposely

been placed for nearly a year, upright and badly corked, in an ordinary sitting room. From this it would appear that the presence of acet-aldehyd in a wine must be looked upon as a decided mark of unsoundness. Although, then, acet-aldehyd is the only one of the series which has been proved to be present in wine, it is not improbable that part of the bouquet of wine is due to the presence of some of the higher members of the series.

Compound Ethers.—Whenever we have a mixture of alcohols and acids, compound ethers begin to be formed. The amount of alcohol ultimately converted into compound ethers depends upon the relative proportions of alcohols, acids, and water present in the mixture. It should be distinctly understood that the amount of alcohol or alcohols finally converted into compound ethers, expressed in its equivalent of ethylic alcohol, is independent of the nature of the alcohols and acids present, and depends solely on the relative proportion of alcohols, acids, and water present. If, on the other hand, we add an excess of any compound ether to a wine, this will at once begin to be decomposed, until, ultimately, the wine will contain no more than it would otherwise have reached in the natural order of things. Berthelot has given a formula, by means of which this proportion can be calculated, and we have thus, in these compound ethers, a most valuable means to judge of the genuine character, age, &c., &c., of a wine. In young wines the amount should fall below the calculated proportion, in old wines it should correspond with it. The compound ethers, like the acids, may be divided into volatile and non-volatile. To the former class the smell and bouquet of a wine are chiefly due; the latter have but little influence on the character of a wine. Pure natural wines contain, according to my experience, invariably a greater proportion of volatile than fixed ethers. The same is the case with some fortified wine, as Sherry and Madeira. Fortified wines, on the other hand, except those just mentioned, generally contain a greater proportion of fixed ethers. The total amount of compound ethers contained in a wine is extremely small. Thus, taking the highest proportion I have as yet met with (in a Madeira fifty years in bottle) the alcohol present in the compound ethers amounted to 1 part in 800 parts of wine equivalent, roughly speaking, to about 1 part of compound ether in 300 parts of wines.

Sugar.—Grape juice contains two kinds of sugar in equal proportions, namely, grape sugar and fruit sugar. It would appear, however, that during fermentation more grape than fruit sugar is decomposed as a rule, so that the sugar remaining in the wine consists chiefly of fruit, or left-handed sugar. Roughly speaking, I have found it to consist of about 1 part of grape to 3 of fruit sugar. If any inspissated must or cane sugar has been added to the wine, the proportion of grape sugar found increases. Any cane sugar added is speedily converted, by the action of the acids of the wine, into invert sugar, a mixture of grape and fruit sugars, identical with that found in grape juice. Thus champagne, which is sweetened by the addition of cane sugar, contains almost pure invert sugar, or 1 part of grape to 1 of fruit sugar, the change being accomplished in less than four weeks. Should any grape, potato, or starch sugar have been added, the proportion of this sugar may of course rise still higher, and may even exceed the fruit sugar in amount. Pure natural wines, when more than a few years old, contain, as a rule, but little sugar; very rarely as much as 1 per cent., and generally very much less. Young wines of this class not unfrequently, however, retain as much as from 2 to 6 per cent. Fortified wines, in which the fermentation has been stopped by addition of spirit, or to which concentrated must has been added, frequently contain up to 5 per cent. of sugar, and in some liqueur wines the sugar rises even to 25 per cent. Champagnes usually contain from 4 to 10 per cent.

Glycerine and Succinic Acid.—Both these are produced from sugar during fermentation. According to Pasteur, 107 parts of cane sugar, or 112.8 parts of grape suga

yield about 3.6 of glycerine and 0.6 parts of succinic acid. In a natural wine, the glycerine should thus amount to about $\frac{1}{4}$ part of the alcohol present.

Albumenoid Substances.—White wines, properly fermented, are almost free from albumenoid matters, they having been decomposed or precipitated during or soon after fermentation. Red wines, and most fortified or imperfectly fermented wines, contain, when young, an appreciable amount of albumenoid matters. In the course of time, however, the greater part is thrown down with the colouring matter and tannin.

Colouring Matter.—In so-called white wines the colour should, strictly, be due to the oxidation products of tannin. The colour generally takes years for its development, and rarely becomes very dark. The public, however, do not like a very pale wine, and, accordingly, more or less colouration is imparted to the wine by the addition of a little caramel. The colour of wine to which concentrated must has been added is of course due, in great measure, to the same cause. Red wines owe their colour to the presence of a blue colouring matter, which, during fermentation, is extracted from the husks of the grapes, and is turned red by the acids of the wine, the grape juice itself being in most cases colourless. Little is known, as yet, regarding the exact nature of this blue colouring matter of wine, but the subject is one which well deserves, and would no doubt repay, careful investigation.

Mineral Substances or Ash.—All wines when they are evaporated, and the residue left is incinerated, leave a greater or less proportion of ash. The nature and proportion of ash left by a wine is one of its most characteristic features. Speaking generally, the total amount of ash left by pure natural wines ranges between 0.15 and 0.25 per cent. Under normal conditions this ash consists of carbonate, sulphate, phosphate, and chloride of potassium, chloride of sodium, phosphate and carbonate of calcium, with traces of magnesia, iron, silica, and frequently lithium and manganese. The carbonates are not, of course, present as such in the wine, but are produced during incineration. If the amount of mineral acids present is insufficient to neutralise all the bases, carbonates will be found in the ash; if, on the other hand, mineral acids predominate, carbonates are absent. This latter is, I believe, rarely or never the case in an absolutely pure natural wine, though it may happen in a wine which yet ought not, on that account, to be called adulterated. It is sometimes found absolutely essential for the preservation of a wine to charge it slightly with sulphurous acid: this, in the course of time, becomes sulphuric acid, and thus the mineral acids are increased, and may outbalance the bases. In some cases the must is charged with sulphurous acid, which of course has the same effect. If, on the other hand, a sour wine has been partially neutralised by the addition of alkali, carbonates will be found in excess in the ash, which of course will also be more than it should be. In many southern countries, notably in Spain, it is the custom to add plaster of Paris to the must, or rather this is thrown on to the grapes before they are crushed. Now, the sulphate of calcium added and the cream of tartar contained in the must—both of which would be almost insoluble in the finished wine—yield soluble sulphate of potassium, insoluble tartrate of calcium, and some free sulphuric acid. One of the effects of the plastering is thus a notable increase in the amount of ash left by the wine, due to the production of soluble sulphate of potassium in place of the almost insoluble cream of tartar. In wines so treated—as, for example, in all sherries—the ash frequently rises to 0.5, or even more, per cent. The part of the ash soluble in water is in these cases chiefly—in many cases even entirely—composed of sulphate of potassium, because the small amount of sulphuric acid, produced as above described, increased not unfrequently by the sulphuring of the must or wine in the course of evaporation and incineration, expels the hydrochloric acid from the chlorides, and of course prevents the production of carbonates. Such wines frequently contain

more sulphuric acid than can combine with the bases present, and accordingly we find more sulphuric acid in the wine itself than in its ash. No wine is met with free from chlorides. It may be worth while to point out a material difference in the effect of sulphuring and plastering must or wine, both of which processes increase the amount of sulphuric acid in the wine. The effect of sulphuring is simply a substitution in the ash of sulphuric acid for chlorine and carbonic acids. It may have the effect of expelling both these from the ash, or even of producing a trace of free sulphuric acid in the wine, but it does not materially increase the proportion of ash found. Plastering, on the other hand, by changing—as above described—the difficultly soluble cream of tartar into soluble sulphate of potassium, very materially increases the proportion of ash afterwards yielded by the wine.

Total Dry Residue and Extractives.—Pure natural wines generally leave from 1.5 to 3 per cent of total residue on evaporation. In fortified wines and champagnes this total residue frequently rises to 6, 8, or even 10 per cent, the greater proportion consisting, in these cases, of sugar. In some liqueur wines the residue rises up to 25 per cent or more. If from this residue we subtract all those substances at present admitting of estimation, a certain proportion will be found unaccounted for. This constitutes what are generally called the extractives. No genuine wine is free from these. In wines free, or almost free, from sugar, these extractives usually constitute the greater portion of the total residue.

A table giving a few analyses of each of the principal wines imported, with the report of the discussion, will appear in our next number.

NOTICES OF BOOKS.

Sun and Earth as Great Forces in Chemistry. By T. W. HALL, M.D. London: Trübner and Co.

THE title of this work may possibly at first lead the reader to imagine that it treats of some new form of force of which the sun and the earth are the sources. This, however, is an error. The sun is viewed here merely as a source of heat. The author, moreover, speaks of the “sun and all other heat sources” of “the sun and of secondary sources,” &c. Thus it may be fairly asked whether the word “sun” is not here a mere synonym for heat in the widest sense of the word, whether emanating from the sun, the fixed stars, or from the earth. Now that heat is a “great force” in chemistry is universally admitted, even by those who may not feel disposed to grant the author’s view that the entire of chemical phenomena are merely “heat acting upon matter.” It strikes us that there is at present a tendency rather to overrate than to neglect the chemical importance of heat, and to make chemistry a mere subsidiary province of thermotics, just as at one time it was viewed too exclusively as a department of electricity.

We will, however, endeavour as briefly and as fairly as possible to place Dr. Hall’s leading views before our readers. He declares that on our globe, for every portion of matter or chemical, there exists a great, equal, and constant heat-source, the average quantity of heat supplied to the earth by the sun. This average quantity, however, fluctuates to such an extent as greatly to affect the aggregate condition of various substances. Mercury is frequently a solid at Nertchinsk, and ether a vapour in equatorial Africa. For every portion of matter or chemical there exist also its brother chemicals, and one vast chemical, the whole earth.

We perceive that “chemical” is used by the author as strictly synonymous with “matter.” But any portion of matter can only be regarded as a “chemical” in so far forth as it is capable of entering into chemical reaction. When its strongest affinities under existing circumstances

are gratified, and it is brought into a state of equilibrium, it ceases to be a chemical, just as the weight of a clock which has run down ceases to be a weight as far as the clock is concerned. This is the case with the great bulk of matter of which the earth, or at least those parts of it known to man, is composed. Each element has combined with those other elements which were accessible, and for which, under existing circumstances, it has the greatest affinity. Does it not then cease to be a "chemical" until the existing equilibrium is disturbed? Chemical action is not modified by the proximity of foreign bodies, unless they are volatile. To return:—

Further, in a chemical there exists a heat constitution, that is, conductivity and capacity for making heat in various ways latent; this heat constitution has a double function of giving and taking heat: from the hotter a chemical, by its heat constitution, takes heat; to a colder the chemical, by the same constitution, equally gives heat. Further, latent and allotropic heat are correlated to state, form, dilatation, &c., of matter or chemicals. Hence, chemicals, say the elements, are subject in our planet by virtue of their heat constitution to two forces, sun-heat and earth-heat, which last, compared with sun-heat is coldness, and from the correlation that exists between state, form, dilatation, &c., of matter, and latent and allotropic heat we can demonstrate sun effects and earth effects upon chemicals. The tendency of sun-heat acting upon matter through matter's heat constitution will always be to give matter latent heat, or to make matter gaseous, or to expand matter. The tendency of the earth's coldness will be to diminish matter's latent heat, or to make matter solid, or to contract it. Hence, sun effects are antagonistic to earth effects; and when sun-heat in our planet raises matter to a gas, sun-heat does so by coercing the earth's antagonistic tendency to make matter solid. Hence, sun-heat so occupied is a force neutralised by another force, and seems to disappear or become latent.

Chemical elements, being subject to two forces and having different heat constitutions, take some of the earth's coldness, and others the sun's heat; hence, some elements are solids and others are gaseous, &c.

Now that the temperature of the earth is lower than that of the sun no one will dispute. Still she radiates heat out into space though non-luminous and of a lower tension. How, then, can she be a source of "coldness" acting antagonistically to the sun? Suppose her altogether withdrawn, would a given body, now lying on her surface, become hotter or colder? Experience tells us that if we remove bodies from her influence even to the small distance which can be reached in a balloon ascent, their state of aggregation is altered. Solids contract and liquids solidify. Surely, then, we are compelled to admit that the earth does not, in this respect, act as the antagonist, but as the assistant of the sun. That she has any tendency to make matter solid by her "coldness" is an utterly unproved hypothesis.

We regret that we do not recognise in this work any principle which appears to be at once true and fruitful,—the conditions which may be fairly required of every new theory.

Journal of the Society for the Promotion of Scientific Industry. Vol. i., No. 2; October, 1874. Manchester: published by the Society.

THIS number contains the commencement of a memoir on "Anthracen and its Derivatives," by Dr. G. Auerbach, and an account of the pâte-sur-pâte style of decorating ceramic ware, by E. Loche.

Mr. G. E. Davis gives an interesting account of the new salt-cake process as carried on at the Atlas Works, Widnes (Messrs. Hargreaves and Robinson). The sulphurous acid gas from the pyrites-burners, mixed with steam and atmospheric air, is passed directly over the salt without the use of lead chambers. The patentees

state that the total consumption of fuel amounts to 12 cwts. for every ton of salt-cake produced. A fair average sample of the cake produced showed:—

Insoluble matter	1.989
Sulphate of alumina	1.062
Sulphate of lime	1.605
Sulphate of soda	94.582
Chloride of sodium	0.052
Free sulphuric acid	0.648
	<hr/>
	99.938

There is also an anonymous paper on the utilisation of peat, and a letter by Mr. C. Dreyfuss on the recent progress made in the dyeing and printing of calico.

Monthly Report of the Department of Agriculture for October, 1874. Washington: Government Printing Office.

THIS is an official document replete with valuable information on the condition and progress of agriculture in the United States. Passing over the statistical department, market reports, &c., we find among the Chemical Memoranda an account of a "curious deposit of phosphatic material" found in a cave near Savannah. No account is given of its extent or surroundings, but it is described as "white, pulverulent, becoming lumpy upon compression, and apparently the result of decomposition."

On analysis it was found to contain:—

Insoluble silica	6.20
Soluble silica	0.60
Lime	14.32
Magnesia	3.43
Alumina	13.53
Peroxide of iron	7.34
Soluble phosphoric acid	8.40
Insoluble phosphoric acid	6.10
Potash	2.53
Soda	0.375
Sulphuric acid	3.87
Chlorine	trace
Nitric acid	trace
Carbonic acid	trace
Moisture	16.10
*Organic matter	16.25
	<hr/>
	99.045

* Containing nitrogen = 0.1445 of ammonia.

That this substance must have considerable manurial value is not to be doubted. But its origin is problematical. From the guanos it is distinguished by its large proportion of alumina and iron no less than of soluble phosphoric acid. 16 per cent of organic matter with only 0.119 per cent of nitrogen is also remarkable. It is to be regretted that the author of the memoir did not make a separate analysis of the soluble and insoluble portions.

Observations are quoted proving that both the rainfall and the atmospheric moisture are measurably greater in forests than in denuded districts in situations otherwise similar.

Experiments have been undertaken with a view of proving the identity of *Pemphigus vitifoliae*, (the leaf-gall louse of Fitch) with the well known *Phylloxera vastatrix*. The results were negative. America seems to be suffering very extensively from a number of insect pests whose weak side has not been hitherto discovered.

Report of the Commissioner of Agriculture for the Year 1873. Washington: Government Printing Office.

THIS report contains a vast and well assorted store of information. Turning naturally to the chemical department, we find analyses of some marls and natural manures which are in extensive use. One from Abingdon, Virginia, consists of:—

Moisture	0.100
Silica	34.655
Peroxide of iron and alumina..	14.542
Phosphoric acid	0.563
Lime	22.207
Magnesia	9.614
Carbonic acid	17.448
Alkalies	traces
Loss	0.871

100.000

This is said to have "produced a very marked and beneficial effect" on corn till the dry weather set in. Such a result in the absence of nitrogen and potash, and with so small an amount of phosphoric acid is remarkable.

A kind of guano found in a cavern near Huntsville, Alabama, and supposed to consist of the modified excrements of bats gave:—

Moisture	11.600
Silica, insoluble	30.810
„ soluble	3.180
Organic matter, insoluble ..	28.687
„ „ soluble	10.573
Free ammonia	trace
Phosphoric acid, insoluble ..	1.5016
„ „ soluble.. .. .	1.305
Peroxide of iron	1.428
Alumina	3.210
Lime	4.110
Magnesia	3.110
Soda	0.312
Nitric acid	0.122

99.9486

The total amount of nitrogen is 3.72 per cent.

Some experiments on opium growing have been made in the United States. Samples from North Carolina yielded 5.01 per cent of morphia; from California, 5.75 per cent; but from Vermont, 15.75, which last result is higher than the average Smyrna quality.

Mention is made of a soil in South Carolina which has the appearance of fertility, but in which cotton cannot be raised. The mischief is ascribed with great probability to the presence of proto-sulphate of iron, and a heavy dressing of lime is recommended.

The microscopic investigations by Mr. T. Taylor, on the phenomena of various blights, including the potato disease, are very interesting.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 6, February 8, 1875.

Magnetisation of Steel Bars Fitted with Armatures.—M. J. Jamin.—The author's researches point to an important modification in the construction of magnets. Supposing a great number of plates, which, after being separately magnetised to saturation, are placed together. The magnetism of the combination will be seen to increase up to a limit which cannot be passed, and which is reached when the polar surfaces are filled. Suppose that ten plates are required. If now were-commence the same experiment, applying the same plates against two iron armatures of a large surface, the intensities will increase much more slowly, because the sum of the magnetism is diffused over a more considerable extent, and the limit will not be reached till this extent is full. For this it may be needful to superpose 20, 30, or 40 plates, and, generally

speaking, a number so much the greater as the armatures are larger. The total power of the magnet will, therefore, increase with its armatures.

M. Menier's Communication on the Pulverisation of Manures.—M. Chevreul.—The author points out that M. Menier exaggerates the influence of mechanical subdivision.

Optical (Double Refractory) Characteristics of the Four Principal Triclinic Felspars, and on a Process for their Immediate Recognition.—M. Des Cloizeaux. This interesting mineralogical paper cannot be made intelligible without the accompanying six diagrams.

M. Mendeleef's New Balance.—M. Salleron.—This paper is also useless without the accompanying diagrams.

New Electro-Magnet formed of Concentric Iron Tubes, Separated by Coils of a Conducting Wire.—M. J. Camacho.—Already noticed.

New Note on the Molecular Equilibrium of Solutions of Chrome Alum.—M. Lecoq de Boisbaudran.—A continuation of the controversy between the author and M. Gernez.

Note on the Action of the Hydrate of Baryta on Certain Mineral and Organic Compounds contained in the Products of Beet-Root.—M. P. Lagrange.—The author recommends the hydrate of baryta for eliminating all phosphoric acid from the potash obtained from the residues of the beet-root sugar works.

Certain Beet-Roots called "Rootz" (Racineuser).—M. Ch. Viollette.—The author contests the view of M. Peligot that the percentage of sugar depends on the quality of the seed. He considers that a poor yield generally results in a clayey, compact, irregular soil.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin
No. 16, 1874.

Presence of a Diastatic and Pepton-Forming Ferment in the Seeds of Tares.—V. Gorup-Besanez.—The constant occurrence of leucin and asparagin in the germs of tares (when germination took place in the absence of sun-light) was shown by a series of experiments conducted by H. H. Will under the author's supervision. In a further series of experiments, where tares were sowed in garden-earth under normal conditions, both these compounds were found to be absent. They were also absent in the seeds. That albumenoids present in the seeds undergo transformation during the process of germination was rendered very probable by the circumstance that the legumin present in the seeds is no longer to be found in the young shoots. It was, in fact, demonstrated by a number of carefully executed experiments that there is contained in the seeds of tares a ferment, capable of being extracted by glycerin, and which very energetically converts starch into glucose and albumenoids (fibrin into peptones). The author is engaged with further experiments on the preparation of this ferment in a state of purity.

Reduction of Benzo-Phenon.—W. Staedel.—With reference to the experiments of M. P. Barbier (*Comptes Rendus*, lxxix., p. 810) the author states that on gently heating an intimate mixture of pulverised benzo-phenon (perfectly pure) and of zinc-powder in a combustion-tube, he invariably obtained diphenyl-methan in abundance.

Oxidation of Ammonia by Ozone.—L. Carius.—The author obtained as products of this reaction nitrite of ammonia and peroxide of hydrogen.

Explanation.—J. Piccard.—This "explanation" relates to a "reclamation" by H. Hlasiwetz in an earlier number of the *Berichte*.

Degradation of the Colour of Vermillion, Occasioned by Contact with Copper and Brass.—K. Heumann.—This paper has already appeared.

Chlorinised Phenyl-Mustard Oil and its Derivatives. F. Beilstein and A. Kurbatow.—The authors have obtained dipara-chlor-phenyl-sulph-urea, $\text{CS}(\text{NC}_6\text{H}_4\text{ClH})_2$, from para-chlor-aniline, CS_2 , and alcohol; it forms white, shining needles, melting at 168° . Para-chlor-phenyl-mustard oil, $\text{CSNC}_6\text{H}_4\text{Cl}$, cannot be advantageously prepared from sulph-urea and P_2O_5 , the yield being too small. It forms long shining needles, which melt at 45° to 47° . Tri-para-chlor-phenyl guanidin, $\text{C}_{19}\text{H}_{14}\text{Cl}_3\text{N}_3$, crystallises in fine needles. It is soluble in alcohol and ether, insoluble in water. If heated with CS_2 to 230° it is resolved into oil of mustard and sulph-urea.

Alkaloid Body in the Organism.—A. Dupré.—As regards the communications of Selmi, Rörsch and Fassbender, and Schwanert (*Berichte*, vi., 142; and vii., 1064 and 1332) it must be remarked that Bence Jones and the author, in 1866, pointed out the existence of an alkaloid in all organs, tissues, and fluids of the human and animal body (*Proc. Roy. Soc.*, xv., p. 73; *Jahresberichte*, 1866, 753; and *Zeitschrift für Chem.*, 1866, 348).

Communication on Raw and Pure Wood-Spirit.—M. Grodzki and G. Kraemer.—In addition to its well-known constituents, acetone, acetate of methyl and methylic alcohol, mesitylic oxide, and phorone, allylic alcohol must be regarded as constantly present in raw wood-spirit.

Preparation of Gaseous Hydriodic Acid.—A. Bannow.—The author finds Topsoe's method for the preparation of pure hydrobromic acid available also for the hydriodic. Red phosphorus is put in a tubulated retort, and a solution of 2 parts of iodine in 1 part of liquid hydriodic acid, of 1.7, is allowed to enter gradually through a dropping-funnel. The development takes place at first without the aid of heat. After the whole of the iodine has been added a gentle heat may be applied. The proportions should be arranged so that iodine and phosphorus may act upon each other according to the formula P_2I_5 . If heat is applied too early a considerable sublimate of iodophosphonium is obtained.

Interesting Oxidation of Metallic Aluminium.—C. Jehn and H. Hinze.—A piece of aluminium was rubbed strongly upon white soft leather, which was saturated with mercury. The rubbed metallic surface became hot and dull, and in a few moments white protuberances, about 3 m.m. in height, gradually grew out of it. On examination they proved to be pure alumina. Aluminium rubbed without the presence of mercury is not oxidised.

Action of Bromine upon Aldehyd.—A. Pinner.—Upon paraldehyd, diluted with twice its weight of glacial acetic acid, and kept cool by being surrounded with water, bromine was allowed to flow very slowly. The drops dissolve at first in the aldehyd, and colour it a pale yellow. After a short time the temperature rises, and the yellow colour disappears. On further additions of bromine the liquid becomes deeper coloured, but the reaction does not cease till 3 equivalents of bromine have been added. In this manner the author obtained bibromaldehyd and tribromaldehyd, or bromal.

Ortho-Brom-Benzic Acid.—Th. Zincke.—Not adapted for abstraction.

Action of Reducing Agents upon Benzo-Nitranilin and Benzo-Nitro-Toluydin.—Chichester A. Bell.—The author concludes from his experiments that in the benzol derivatives of meta-nitranilin (melting-point 110°), and meta-nitro-toluydin (melting-point 77.5°), the acid group cannot be reduced.

The Pseudo-Nitrols.—V. Meyer and J. Löcher.—Not adapted for abstraction.

Diagnosis of Primary, Secondary, and Tertiary Alcohols and Alcohol-Radicals by Colour Reactions.—V. Meyer and J. Löcher.—Reserved for future insertion.

On Ethyl-Toluol.—P. Jannasch and A. Dieckmann.—The authors have undertaken the synthesis of ethyl-toluol from para-brom-toluol, iodide of ethyl and sodium.

The reaction was somewhat slow. Pure benzol was used as solvent. Large quantities of para-brom-toluol must never be decomposed at once.

Reduction of Metallic Oxides by Hydrogen, and Application to the Detection and Quantitative Determination of Metals.—W. Müller.—Reserved for future insertion.

Remarks on the Paper by N. Sokoloff and P. Latschinoff on the Action of Ammonia upon Acetone.—W. Heintz.—A controversial notice of the article (*Berichte*, vii., p. 1384).

"In Defence."—Ernst Schmidt.—A reply to Liebermann's critique on the author's memoir on anthracene and chrysen.

Application of the Nitric Oxide and Sulphide of Carbon Light to Photographic Purposes.—E. Sell.—The author has anticipated MM. Delachanal and Mermet (see *Comptes Rendus*, November 9, 1874) in the application of this light to photographic purposes, and had patented it in England October 10, 1873, No. 3288.

Forty-Seventh Meeting of German Naturalists and Physicians, Held at Breslau, September 18th to 24th, 1874 (Chemical Section).—Reported by R. Biedermann and H. Römer.—In the opening address Löwig called particular attention to the merits of J. B. Richter, the "Kepler of Chemistry, and discoverer of the law of chemical proportions."

F. v. Heyden spoke on salicylic acid, which he had prepared by Kolbe's method on the large scale.

E. Schmidt gave an account of the oxidation-products of isobutylic alcohol, of methyl-isopropyl-ketone, of the sulph-acids of naphthyl-aniline, and of the action of sulphuretted hydrogen upon alkaloids.

Heumann described certain compounds of mercury and copper, *Berichte*, pp. 1388 and 1390.

J. Müller reported on the occurrence of pyrocatechin in the urine of a child.

H. Landolt exhibited some interesting experiments with "inverted flames."

Dr. Lunge, of South Shields, gave an interesting account of the most recent improvements in the alkali manufacture, with especial reference to English establishments. His speech was illustrated by detailed statistics and the exhibition of plans. He first described certain changes in the manufacture of sulphuric acid, especially the introduction of Glover's tower, now very general in England, and the treatment of cupriferos pyrites. These have almost banished other sources of sulphur from England, the burnt ores being worked both for copper and iron. It is highly probable that the manufacture of sulphuric acid will soon be eliminated from the sphere of the alkali trade, since the process of Hargreaves, by which sulphate of soda is produced by the action of sulphurous acid and air upon chloride of sodium, proves satisfactory in practice, and is already carried out on a large scale in four establishments in England. Three more are in course of completion. In the soda manufacture, in the strict sense of the word, Leblanc's method is still supreme. Two small works for the ammonia process are being erected, but the majority of English manufacturers have no faith in this method. In the ordinary process the revolving soda furnaces have overcome all difficulties, and the abolition of the furnaces requiring manual labour is, in England, merely a question of time. In the manufacture of chloride of lime and chlorate of potash the complete abandonment of the old manganese process is still closer at hand. As for the new methods, that of Dunlop (conversion of manganic chloride with carbonate of lime by means of steam at a tension of 2 to 4 atmospheres, and calcination of the carbonate of manganese at 300° to 400°) is only at use at St. Rollox, near Glasgow—not even in the branch establishment of the same firm at Newcastle, where Weldon's process is in operation. The quantity of chloride of lime and chlorate of potash—the latter estimated at seven times its weight of the former—made in England in the current year is—

Made with manganese	10,000 tons.
Made by Dunlop's process	10,000 „
Made by Deacon's process	5000 „
Made by Weldon's regeneration process	60,000 „
	<hr/> 85,000

The decision between the processes of Deacon and Dunlop is no longer doubtful. In England, twelve works have been built on the former principle, seven of which are already quite out of use, and the remaining five in a very imperfect state. In the rest of the world there are only two, recently commenced in Germany. The failure of this beautiful and promising process springs from the circumstance that the balls of clay, saturated with sulphate of copper, cease to act. On Weldon's system there are in England—

	Establishments.	With Oxidation-Towers.
At work	32	54
Building	15	23
	<hr/> 47	<hr/> 77

These are said to produce 80,000 tons yearly, but their full power is 150,000: eight or nine more works are projected. There is one in Belgium; in France three are in course of erection, and one is projected; in Germany there are one or two at Saarau.

A. Mitscherlich read a paper on his new method of elementary organic analysis. The apparatus cannot be described without the aid of illustrations (*Berichte*, vi., p. 1000).

H. Fittica gave a communication on isomeric nitro-toluylic acids, azo-toluylic acids, and on a second cymol-sulphuric acid.

E. Nölting gave the results of his researches on brom-benzol-sulphuric acid and its derivatives.

Otto Witt described certain new colouring matters—those of Croissant and Bretonnière,—and on a method for preparing organic cyanides. The colours he regards as produced by the action of alkaline sulph-hydrates upon hydrates of carbon.

H. Biedermann spoke concerning the “replacement of the amido group in nitramins by hydroxyl,” by means of boiling with concentrated soda-lye.

A. Mitscherlich communicated the results of his observations on the “combustion-point.”

H. Kral showed that oleic acid absorbs great quantities of oxygen, and converts it into ozone. When used in lamps it develops a strong light and an extraordinary heat.

H. Maschke recommended hæmatoxylin as an indicator in alkalimetry.

Dr. Franck complained of the present neglect of mineral chemistry.

Prof. Böttger gave a communication on the detection of ammonia, nitrites, and nitrates in potable waters. He gave instructions for preparing the iodide of cadmium and starch test-liquor for detecting nitrites. By previously treating samples of water with cadmium and dilute sulphuric acid nitrates, if present, are reduced to nitrites, and may be detected by the same test-liquor.

H. Böttger proposed stannite of soda for recovering gold from weak baths. He showed that a galvanic coating of nickel, being less porous than gold, protected iron better against rust. To obtain salts of nickel free from iron, the solution is acidulated, and carbonate of soda added till a little carbonate of nickel is thrown down. The mixture is boiled for half-an-hour, when the solution will be found quite free from iron.

H. Maschke exhibited Goppelsröder's test for alumina. If to a dilute solution of this earth a trace of very dilute alcoholic solution of morin is added, a green colouration appears.

Report of the Mineralogical and Geological Section.—H. Römer.—H. Schuchardt explained the composition of

Vesczelyte, a mineral lately discovered by Vesczely in the Delius mine, near Moriwiza, in the Banat. It is a phosphate of copper with 4CuO . The following series is thus known:—

Libethenite ..	$4\text{CuO}, \text{P}_2\text{O}_5 + \text{H}_2\text{O}$.
Tagilita ..	$4\text{CuO}, \text{P}_2\text{O}_5 + 3\text{H}_2\text{O}$.
Vesczelyte ..	$4\text{CuO}, \text{P}_2\text{O}_5 + 5\text{H}_2\text{O}$.

H. von Lasaul described “Siegburgite,” a new fossil resin from Sieburg, near Bonn, distinguished for its high proportion of carbon—85 per cent.

H. Frank described some experiments for the artificial production of Kieserite ($\text{MgSO}_4 + \text{H}_2\text{O}$), and Thenardite (Na_2SO_4).

Prof. F. Römer gave an abstract of Harting's paper on a fulgurite found at Elspeet, in Geldern, August 11, 1872.

Liebig's Annalen der Chemie und Pharmacie.

Heft 1 and 2, 1874.

Behaviour of Neurin with Albumenoids.—Julius Mauthner.—The author finds that fibrin if mixed with a solution of neurin, even very dilute, and boiled, or set aside in the cold, swells strongly, and dissolves at last completely. The solution, in a dilute state, can be readily filtered. It is not precipitated on the addition of alcohol, and does not blacken sugar of lead on boiling. If common salt is added in excess the fibrin is precipitated, but re-dissolves on the addition of an excess of water. The addition of acids produces a copious, white, flocculent precipitate, soluble in excess of acid, which when dried appeared as an amorphous, brittle, hard, brown substance. It was found to contain, on analysis,—

Carbon	52.73
Hydrogen	7.26
Nitrogen	15.65

With egg-albumen the behaviour of neurin is similar. These two bodies may be boiled together without coagulation, and coagulated albumen dissolves in neurin.

Constitution of the Uric Acid Group.—Dr. L. Medicus.—A hypothetical paper.

Communication from the Laboratory of the University of Halle.—This consists of an examination of the behaviour of hydrochlorate of diacetamin on exposure to heat, by W. Heintz.

MISCELLANEOUS.

The Faraday Lecture.—The triennial “Faraday Lecture” of the Chemical Society was delivered last evening, in the theatre of the Royal Institution, by Dr. A. W. Hofmann, of Berlin, before the Prince of Wales and a crowded meeting, which included a number of the most distinguished members of the English scientific world, the subject being “Liebig's Contributions to Experimental Chemistry.” On concluding, the lecturer was presented by Dr. Odling, F.R.S., with the Faraday gold medal, the award of which is the highest honour the Society has the power of conferring. A report of the Lecture will shortly appear in these columns.

NOTES AND QUERIES.

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THE CHEMICAL NEWS.

VOL. XXXI. No. 800.

PROCESS FOR THE ESTIMATION OF COLOUR IN WATER.*

By J. FALCONER KING, City Analyst, Edinburgh.

DURING the later months of the year 1873 and the spring of 1874, I had occasion to examine and report upon many samples of water, chiefly in connection with the water supply of Edinburgh.

As is well known, there were several schemes proposed for the supply of the city, and samples of water from most of them were submitted to me for examination.

The analyses, as usually performed, showed all these waters to be very much alike, because the main and almost only difference between them was the extent to which they were coloured. By the ordinary mode of analysis hitherto in general use, this most important feature would either not have been described at all, or would have been described in language so vague as to be totally unintelligible. We find, for instance, in many reports of analyses of water, the colour stated as being much or little, or by some meaningless or incomparable terms, as yellowish or brownish, which are altogether without significance, as no one can tell with precision what is wished to be indicated by such vague expressions, and which preclude the possibility of comparison, or of the character of the water being accurately recorded, as that tint which one observer would consider as fairly characterised by one name, might quite possibly, and would indeed most probably, be in the opinion of another deserving of quite a different appellation. In addition, therefore, to the usual details set forth in reports of water analyses, I found that in order to permit of the merits and demerits of these different waters being properly discussed, compared, and recorded, it would be necessary to have the depth of colour of each exactly and definitely stated. To enable me to do this, I elaborated a process for the estimation of colour in water, which I will now have the pleasure of describing to the Society, and which, I may add, has lately been employed both by myself and others, and has been found in every way satisfactory.

The process, which is extremely simple, consists in adding to a known quantity of pure distilled water contained in a glass tube, an aqueous solution of caramel, of a certain strength, from a burette, until the tint communicated to the distilled water is found to equal that of the water under examination.

The tubes I employ are made of glass as free from colour as possible; they should be 15 inches long, and of such diameter that when filled to within 3 inches of the top, they will contain 8 ounces of water exactly.

Preparing the standard solution of caramel is the only part of the operation attended with any difficulty. It is done by adding caramel to distilled water until the proper depth of tint has been attained. The depth of colour which it should possess is ascertained as follows:—To 8 ounces of pure water, perfectly free from ammonia, contained in a glass tube, and forming a column 12 inches long, add 10 grains by volume of solution of ammonium chloride, containing 3.17 grains of the salt in 10,000 grains of water (or 0.0001 grain of ammonia in 1 grain of solution). To this mixture, after proper agitation, add 25 grains by volume of Nessler's solution, of the usual strength; allow this, after mixing, to repose for ten minutes, at a temperature of 60° F., when the colour produced will equal 30° on my scale. That is, 300 grains by volume, or 30° (a degree being equal to 10 grains by

volume) of caramel solution, if of proper strength, will produce exactly the same depth of colour when added to the same amount of distilled water (8 ounces) in a column 12 inches long.

The caramel solution, which I should state can be kept unchanged for a considerable length of time, being thus prepared, all that is necessary to do to estimate the colour of a water, is to fill two tubes, of the dimensions stated above, to within 3 inches of the top, one with distilled water, and the other with the water to be tested; and having placed them side by side on a white slab, in a good light, to add the caramel solution from a burette to the distilled water, until that is found to equal in colour the water contained in the other tube. The burette being graduated in grains, every 10 grains consumed will represent one degree of colour. The intensity of the colour is ascertained by looking down through the length of the column.

This process I have found very efficacious, which fact, with its extreme simplicity, will, I believe, recommend it to all who, like myself, have occasion to examine numerous samples of water.

COAL IN RUSSIA.

(ANALYSES OF SOME SAMPLES).

By SERGIUS KERN, St. Petersburg.

THE fields of best coal in Russia are situated on the Donetz Mountains. Lately, good coal was found on the Oural Mountains. Besides these coal-fields, coal is known in the Governments of Toula and Riasane, also not far from Petersburg in the Governments of Tver and Nowgorod. Some analyses which I annex are the results of my work. In estimating the calorific power of coals, Rumford's calorimeter was used.

Government of Nowgorod.—The coal found here is properly brown-coal (lignite); contains 3—6 per cent of sulphur; quartz, fire-clay, iron-ore, pyrites, in the neighbourhood.

1. River Prikcha, 30 miles to the N. from the town Borovitchi:—

	Per cent.
Carbon	36.70
Volatile matter	46.80
Ash	16.50
	100.00

4500 calorific units; contains 18.90 per cent hygroscopic water; dried coal gives 62.18 per cent coke; 6200 cubic feet of gas per ton.

2. Dried coke from the coal of Prikcha:—

	Per cent.
Carbon	78.03
Volatile matter	10.71
Ash	11.26
	100.00

5910 calorific units; coke good for reverberatory furnaces.

Government Toula.—The coal is found 30—70 feet from the surface; iron-ore near the collieries.

3. Obidimovo, on the Riask-Viasma railway-line; 15 miles from Toula:—

	Per cent.
Carbon	39.14
Volatile matter	42.65
Ash	18.21
	100.00

4100 calorific units; hygroscopic water 2.55 per cent; 3.23 per cent of sulphur; the coal resembles Scotch bog-head-coal.

* A paper read before the Royal Physical Society.

Government Riasane.—The coal here found is good for reverberatory furnaces and gas-manufacture.

4. Colliery "Mouraevna."—Contains 2.40 per cent of sulphur; 5485 calorific units:—

	Per cent.
Carbon	17.60
Volatile matter	66.26
Ash	8.61
Hygroscopic water	7.53
	100.00

Oural Mountains.—Good coal in many places, but not explored.

5. Coal from Vaschkour, near the river Tchousovaya; 7320 calorific units; gives good coke:—

	Per cent.
Carbon	77.86
Volatile matter	12.30
Ash	2.72
Hygroscopic water	7.12
	100.00

Donetz Mountains.—Vast fields of good coal and best known anthracite, which is used in these places for working blast-furnaces.

6. The "Grouschevka" mine, situated on the Rostov-Voronege railway line; 7640 calorific units:—

	Per cent.
Carbon	90.80
Volatile matter	7.22
Ash	1.98
	100.00

7. Village Alexandrovka: good coal; gives very compact coke; 7690 calorific units; 0.36 per cent of sulphur:—

	Per cent.
Carbon	69.92
Volatile matter	29.00
Ash	1.08
	100.00

8. Village Ouspenskoe, near the town Backmouth: 7970 calorific units; 0.87 per cent of sulphur; the coal gives good coke:—

	Per cent.
Carbon	64.85
Volatile matter	28.90
Ash	6.25
	100.00

DIAGNOSIS OF PRIMARY, SECONDARY, AND TERTIARY ALCOHOLS AND ALCOHOL-RADICALS BY COLOUR-REACTIONS.

By VICTOR MEYER and J. LÖCHER.

If it is required to decide whether an iodide of the series $C_nH_{2n+1}I$ contains a primary, secondary, or tertiary alcohol-radical, it is distilled with nitrite of silver, and the distillate is treated with potash and nitrous acid. If a red colouration is obtained (formation of nitrolic acid), we have certainly a primary alcohol-radical; a blue colour shows a secondary; and the absence of colour a tertiary. As the alcohols are very readily converted into iodides, and these again into nitro compounds, the idea suggested itself that the colour-phenomena observed might be advantageously used for the distinction of very small quantities of the primary, secondary, and tertiary iodides, and in consequence of the alcohols. The authors have found, in fact, that from 0.3 to 0.5 of a gramme is sufficient to decide whether an iodide belongs to the primary, secondary, or tertiary series. With the iodides poor in carbon (of

the methylic-propylic series), 0.3 grm. is sufficient for the production of the characteristic colour. In those richer in carbon, especially of the secondary and tertiary series, 0.5 grm. of the iodide will be needed. In case of compounds very rich in carbon, the use of 1 grm. might be recommended. The following arrangement has been found convenient:—Into a distilling-flask of a few c.c. capacity, with a tube of 4 or 5 inches in length blown in the side, is put a small quantity of dry nitrite of silver (double the weight of the iodide), previously rubbed up with its own volume of fine white sand. The iodide is then added, waiting a few moments until the reaction sets in, when it is distilled over the naked flame without condenser, receiving the distillate in a narrow test-tube. The distillate consists of several drops, and displays the characteristic reaction with great distinctness.—*Berichte d. Deutsch. Chem. Gessel. zu Berlin.*

ON THE MANUFACTURE OF CAUSTIC SODA.*

By JOHN MORRISON, F.C.S.

(Continued from page 123)

NITREING occupies five or six hours, and in those works adopting it about 10 per cent less pot room is necessary, for the violent commotion produced by blowing renders it impossible to fill the pots to the extent admissible in the case of nitreing. The oxidation process at an end, the pot is fired to redness—if not already in that state—and a sample is drawn to ascertain its exact strength. If prepared for 60's, it usually turns out 68—70 per cent; but if for 70's, 70—72 per cent. In either case, it is brought down to the desired strength—that is to say about 1° below 60 or 70 per cent, as the case may be (for the "Liverpool" test usually ranges 1 to 2 per cent beyond the ordinary commercial one)—by the addition of common salt. This, however, lowers the temperature, which must be brought up again by continuing the firing. The salt of course decrepitates violently on coming in contact with the intensely heated mass, and it causes a fine spray surcharged with particles of caustic soda, which produces a new edition of the effects alluded to in speaking of the last stages of concentration. There are, indeed, no less than three objectionable periods in caustic finishing—the nitreing being likewise very unpleasant—which are, I think, in the like order of their occurrence, progressively vicious in their tendencies. The salting is so particularly irritating, that it is usual for the workmen to wear veils and gauntlets for the protection of their faces and arms during this operation. On the conclusion of the salting process, if the lid be withdrawn to one side, the graphite may be seen covering the surface of the batch in the form of a fine metallic-looking film; but when after the reheating which is necessary to ensure proper settling, the lid is removed, the unconsumed portion displays the forms of cinder-like pieces floating here and there on the top of the intensely heated mass. The ultramarine also appears at this stage, coating the rim of the pot and edges of the lid with a blue amorphous-looking deposit.

The pot will be ready for packing within eight to twelve hours of the final removal of the lid, and simultaneous slacking of the fire. This operation is performed by baling. Two or more rows of drums are placed round the working side of the pot, within the radius or sweep of a sheet-iron packing shoot, into the wider end of which the perfectly liquid caustic soda is poured from an iron ladle. If the caustic be up to the mark, it will appear beautifully limpid and colourless—or, according to the workmen's loftier standard, "clear as gin"—as it is delivered from the ladle; and if this be not its condition, and the slightest degree of turbidity be manifested, the product will not be up to the mark when cool; and even though samples drawn from the lid may appear everything to be desired,

* A Paper read before the Newcastle-upon-Tyne Chemical Society.

if the drum be broken the centre or core will be of a dirty grey colour.

On approaching the lower portion of the pot, the workman proceeds very carefully; and as soon as the caustic appears at all doubtful, he ceases to pack, and commences baling the dubious portion into an adjoining pot of strong liquor till he comes to what are termed the "bottoms." Then he plunges the whole thoroughly with his ladle, and packs the red dirty-looking sediment into special drums for sale as "bottoms," or transfers it into iron bogies to be broken up when cool, and re-dissolved in a small "mashing" pan kept for the purpose and provided with a steam pipe, along with any fished salts, scrapings, fluxings, and in fact, any alkaline rubbish too valuable to be thrown away and too inferior to be otherwise utilised. When dissolved to about 48° T., the charge is thoroughly settled, and the supernatant liquor drawn off and causticised, or transferred to settlers for treatment in a manner yet to be described. The deposit consists chiefly of peroxide of iron, and is, after washing, thrown away.

Such, then, is the usual process for the manufacture of white caustic soda; but in the case of cream, a different treatment is necessary. Cream caustic may be manufactured from vat liquor solely, but is better if made of "red" liquor, or the dissolved bottoms just spoken of, either alone or in conjunction with a portion of vat liquor, and it may be prepared either from causticised or uncausticised liquor. If the latter, the thoroughly settled "red" and other liquors are transferred to a long wrought-iron boat pan, say 30 feet by 8 feet, and 2 feet 6 inches deep in the centre, self-fired, and therein evaporated, and occasionally fished as the salts are deposited. On reaching 70° T., or about 250° F., the pan is cooled down, and thoroughly fished. It is then re-heated to boiling, and say $2\frac{1}{2}$ —3 cwts. nitre added, and when, after continued boiling, a sp. gr. of about 94° T., or a temperature of 270° F., is attained, a little more nitre is introduced (if the previous addition was insufficient), and the whole an hour or two afterwards cooled down, and the clear liquor run into a settler. The salts left behind are washed with a little water (which may be added to the next batch), to free them from nitre, and then removed and drained, to be employed for the manufacture of common caustic ash. The liquor, after being thoroughly settled to removed all salts, is run into a caustic pot. As it is delivered from the shoot it appears of a dark straw colour, and when boiling it gives off ammonia copiously. It is desirable to add all the nitre in the pans, so that it is only occasionally, and in small quantities, used during the finishing operation. The pot is fired carefully till a sample tests 60 per cent alkali, which is the usual strength at which cream caustic soda is sold. The batch is of course not fused, a considerable amount of water remaining in the finished product. Occasionally, but usually through careless firing, the batch assumes a red colour, and as that is an incurable disorder, the whole must just be packed and sold as so much inferior caustic, or fired to fusion and used to make up a batch of white. There are no bottoms in cream caustic, the pots being packed right away till empty.

In manufacturing cream caustic from causticised liquor, very much less salts will, of course, be found. Consequently, specially large fishing pans being unnecessary, the liquor may be evaporated in the ordinary cast-iron boat pans. In other respects the process is the same as that just described.

(To be continued).

New Property of Glycerin.—R. Godeffroy, on examining a chemically pure glycerin from the Apollo Japan Works in Vienna, found that when heated to 150° it took fire, and burnt with a steady, blue, non-luminous flame, without diffusing any odour or leaving a residue. The glycerin had the specific gravity 1.2609. This property enables glycerin of lower specific gravity to be burnt by means of a lamp-wick.—*Ber. d. Dent. Chem. Ges. z. Berlin.*

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 18th, 1875.

Professor ODLING, F.R.S., President, in the Chair.

AFTER the minutes of the previous meeting had been read and confirmed, the names of Messrs. G. A. Keyworth, R. H. S. Spicer, F. M. Jennings, R. Cowper, and J. S. Felton were read for the first time.

The PRESIDENT said he would not detain the visitors, as there was one there who had come to address them that evening who was so eminently qualified to set before them the experimental work of the late Professor Liebig, a genius not unworthy of comparison with the great English philosopher in whose honour these lectures had been instituted. He would therefore at once ask Dr. Hofmann to deliver his lecture "*On Liebig's Contributions to Experimental Chemistry.*"

The LECTURER, after noticing the great value of this tribute of homage to the memory of the immortal Faraday, who belonged not merely to the island of his birth, but to the civilised world, said he had selected as the theme of his discourse a subject so rich in interesting facts and noble lessons as of itself to command attention,—the labours of one of Faraday's most eminent scientific contemporaries, of a master mind like his, Justus von Liebig, the only name fitted to stand on equal terms by that of Faraday. If we consider the vast number and great importance of the chemical facts established by Liebig, we must proclaim him one of the greatest contributors to our science, whilst of organic chemistry he is the very source and fountain head. It was he who was the first to found the great institutions of chemical education; at the University of Giessen, Liebig organised the first educational laboratory. From this country more especially was it that a large number of young chemists thronged to his school, many of whom have since attained the greatest eminence. And to these great services may we not add the inspiration bequeathed to us by his illustrious example? For us and for our successors for years to come, it will be our duty to work not only with Liebig's instruments in our hands, but with his dauntless spirit in our hearts.

Like Faraday, Liebig's labours in abstract science have borne abundant fruit in the useful arts; to mention but a few instances,—the industries of the fatty bodies and of acetic acid, the manufactures of the fulminating compounds, of prussiate of potash, and potassic cyanide. It was not, however, merely incidentally that he benefited the industrial arts; his noble researches in the field of agricultural chemistry will ever associate his name with those of Davy and Lavoisier, the great law-givers of modern agriculture. To Liebig we especially owe our knowledge of the important part played by the saline ingredients,—the ashes of plants,—in their nutrition, and consequently, of the necessity of returning these ashes to the soil, after each harvest, in order to renew its fertility. It was in 1842 that, passing on to the intricate chemistry of animal life, he published his work "*On Organic Chemistry in its Application to Physiology and Pathology*;" and as an outgrowth of these researches, we may allude to the Food industry, which has already attained such colossal proportions in the southern hemisphere. We must also bear in mind our debt to Liebig for the discovery of chloroform and of chloral,—invaluable agents placed by chemistry at the disposal of medical art.

From among the various fields here presented, it was necessary to make choice of some one, for more detailed examination, and, considering the special pursuits of his hearers, there could be no hesitation; he would ask them to accompany him in a rapid review of Liebig's labours in pure chemistry, but even here he must confine himself to a few illustrations amongst several hundreds. Of these few, the first alluded to, although perhaps not the most

brilliant, was one which had conduced more than any other to the marvellous development of modern chemistry,—the apparatus, so simple and yet so perfect, for the analysis of organic bodies by combustion; the method for determining the molecular weight of bases by the combustion of their platinum salts, and that for the analysis of air by means of an alkaline solution of pyrogallous acid were also Liebig's.

In passing from the analytical methods, and the apparatus devised by this great chemist, to his researches, we find among the first to claim our attention his investigations in the cyanogen group begun by an examination of the fulminates, from which he naturally passed on to the cyanic group at large; then cyanic acid, cyanuric acid, and their salts became successively the object of his labours. It was he who first gave a satisfactory explanation of the processes involved in the preparation of the yellow prussiate of potash by fusing animal matters with potash in iron vessels, the product first formed being potassium cyanide, which then takes up iron during lixiviation. Amongst the interesting and valuable results arising from his investigation of the ferro-cyanides, were the preparation of hydro-ferrocyanic acid, of potassium cyanide, and potassium cyanate. From the cyanates to the sulphocyanates was but a step; and as, in the course of his experiments, he required large quantities of ammonium sulphocyanate, he ultimately found the best method of preparing this to be the treatment of hydrocyanic acid with yellow sulphide of ammonium. This naturally led to the delicate test for hydrocyanic acid by converting it into ammonium sulphocyanide, when a drop of a solution of ferric chloride produces the well-known blood-red colour. After glancing at the benzoyl compounds, the lecturer noticed the importance of the acid chlorides, first obtained by Liebig from the aldehydes, although Cahours's method is now universally adopted in preparing them. These chlorides furnished us with acids, ethers, and amides, a source of new compounds, not shaken by time, but still fresh and fruitful as on the first day of their discovery.

To Liebig and Wöhler are we indebted for the investigation of the properties and the determination of the formula of uric acid. Its liability to change, while increasing the difficulty of the inquiry, enabled these chemists to reap a rich harvest of results such as few have ever gathered from one field of research; the discovery of not less than sixteen new bodies rewarded their labours, and it is noteworthy that only one of these has since disappeared from our science. To them are we indebted for the first analysis and the first exact and complete description of murexide, the precursor of rosaniline.

Liebig's first experiments on alcohol, the action of chlorine upon it, led to the discovery of chloral and chloroform, two compounds now in continual use for the alleviation of human suffering,—an illustration of the practical advantages ever following the pursuit of truth. Of the former compound, in 1868, probably there was not a kilogramme in existence in the whole world; now the factories of Berlin alone produce 100 kilogrammes daily. The object of the investigation of alcohol was to elucidate the constitution of this important compound, and gave rise to that long-protracted contest between Dumas and Boullay, on the one hand, who considered ether and alcohol to be hydrates of olefiant gas, and Liebig, on the other, who regarded them as derivatives of a radical to which he gave the name of ethyl. It ended in a signal victory for Liebig, and a universal adoption of his theory. The new notation, introduced by Gerhardt and Laurent, and so strenuously supported by Odling, far from invalidating Liebig's ethyl theory, has, by the masterly researches of Williamson, brought that hypothesis to its last and finest development. He would remind them, moreover, that Williamson owed to Liebig the very agents he so successfully employed in the solution of this problem, namely, the ethylates of potassium and sodium.

To Liebig, also, we owe the explanation of the formation of acetic acid by atmospheric oxidation. This action takes place in two stages, the first being the removal of hydrogen and the formation of aldehyde, the second the direct oxidation of this to acetic acid. Aldehyde was first made out by this great chemist, who at the same time discovered another compound,—acetal,—scarcely less interesting. It was on this occasion that Liebig first observed the lustrous mirror-like deposit of silver formed on gently warming a slightly ammoniacal solution of silver with a few drops of aldehyde.

The compounds discovered by Liebig, which have been passed in review, are amongst those in most frequent use; the reactions are those most commonly employed in research. Could a more eloquent testimony be borne to the influence which Justus von Liebig has exercised upon the progress of chemical science than that his teachings have become familiar as "Household words."

In conclusion, the lecturer related a touching anecdote of the goodness of heart displayed by this great philosopher, and a parallel instance of the generous goodness of Faraday, saying that "no two grander examples will in any age stand forth more dignified by their intellectual work, more conspicuous for their moral beauty, than those whose great names we have been commemorating this day—

MICHAEL FARADAY;
JUSTUS LIEBIG."

At the conclusion of the lecture, the experimental illustrations of which were admirably performed by Professor McLeod,—

Dr. ODLING said that it devolved upon him, in the name of the Chemical Society, to tender their heartfelt thanks to Dr. Hofmann for the comprehensive but far from exhaustive account which he had given them of Liebig's labours, and at the same time to offer him the Faraday medal. This, he felt sure, would have a twofold value in his eyes,—as a memorial of a great and good man, and as the highest compliment it was in the power of the Chemical Society to pay. In limiting the choice for distribution of this medal in the way it had done, the Society not only avoided the difficulty of merely complimenting one another by distributing it among themselves, but it brought them into personal contact with the leading men abroad. Amongst the numerous obligations which chemists, and especially English chemists, were under to Liebig, there was one which had been omitted, and to which he might, perhaps, be allowed to advert,—the training of a Hofmann. In the succeeding Faraday lectures he hoped they might be as fortunate as they were on the present occasion.

Dr. HOFMANN, in reply, said it was with sentiments of the profoundest gratitude that he received from his hands what he conceived to be the highest honour that could be conferred on him, and cordially thanked Dr. Odling for the affectionate terms in which he had referred to him. "If an investigator were called on to pronounce the name associated with the most glorious scientific conquests, he would unhesitatingly give utterance to the name of Faraday, and you have placed me in possession of the Faraday medal. How greatly is its value enhanced in my eyes by receiving it on the very spot where Faraday himself was wont to give forth his discoveries! Allow me in a few words to allude to the sympathy expressed in the eyes of the chemists around me,—many the faces of old pupils, whose acquaintance has ripened into life-long friendship. I ever remember with affection my early years passed in this generous country,—my happy stay in dear old England."

The lecture, which took place in the Lecture Theatre of the Royal Institution, was attended by a crowded audience, amongst whom were nearly all the leading chemists of this country. His Royal Highness the Prince of Wales was present as a visitor.

The next ordinary meeting of the Chemical Society will be held at Burlington House on Thursday, April 1st. The anniversary meeting is on March 30th.

PHYSICAL SOCIETY.

March 13th, 1875.

Professor J. H. GLADSTONE, F.R.S., President, in the Chair.

MR. W. CHANDLER ROBERTS read a paper "*On the Electro-Deposition of Iron.*" He referred to the beautiful specimens of electro-iron, the work of M. Eugène Klein, a distinguished Russian engineer and chemist, which were exhibited at the meeting of the British Association at Exeter. In 1870 Mr. Roberts visited St. Petersburg, and had the advantage of receiving from the late M. de Jacobi suggestions which enabled him to deposit iron with much success. He stated that a plate of electro-iron, 150 m.m. square by 2 m.m. thick, was deposited on copper by Herr Bockbushmann in 1846. In 1857 M. Feuquières exhibited specimens of electro-iron at the Paris Exhibition. In England, in 1858, M. Garnier patented his process, termed *aciérage*, for protecting the surfaces of engraved copper-plates; and in the same year Klein produced the admirable works above referred to. The author then exhibited specimens which he had obtained by Klein's method. The bath consists of a double sulphate of iron, and magnesia of sp. gr. 1.155; the chief conditions of success being the neutrality of the bath and the employment of a very feeble current. Iron so obtained possesses a higher conductivity than any commercial iron (Matthiessen), its sp. gr. is 8.139, and it occludes thirteen times its volume of hydrogen. A tube of the metal deposited on a rod of wax, which was vacuum-tight at the ordinary temperature allowed hydrogen to pass freely at a dull red-heat.

After a brief discussion, Prof. GUTHRIE described some experiments which he has recently made, with the assistance of Mr. R. Cowper, in continuation of former researches "*On Salt Solutions and Attached Water.*" The main object of these experiments was to ascertain the manner in which mixtures of salts act as cryogens, and to study their combination with water at various temperatures and in various proportions. When two salts, to which either the acid or the base is common, and which do not form a double salt, are mixed in equivalent proportion, the cryogen produced has nearly the temperature due to the salt, which, alone, would produce the greatest degree of cold. Solidification begins at a temperature below the melting-point of the least fusible, and continues at lower and lower temperatures until the temperature due to the other constituent salt is reached. Occasionally a cryohydrate, having a constant solidifying-point, has been obtained by mixing in definite proportions salts which are not known to exist in the form of a double salt. In all such cases the solidifying-point of the mixture is intermediate between the solidifying-points of the constituents; and its temperature as a cryogen is also between the temperatures of the constituents when separately used as cryogens. When two salts composed of different acids and bases are mixed, and no precipitation occurs, it is generally considered that *partial* double decomposition takes place, two new salts being formed. It was found that if the salts AX and BY be mixed in atomic proportion, and dissolved in the smallest possible amount of water, a mixture identical with that produced on mixing AY with BX is obtained. The temperature and composition of the resulting cryo-hydrate is the same in both cases. But the temperature never falls as low as the point which could be reached by employing whichever of the salts AX, AY, BX, BY, forms a cryo-hydrate with the lowest temperature. Thus a saturated solution of a mixture of nitrate of potassium and sulphate of sodium solidifies at -5°C . A mixture of nitrate of sodium and sulphate of potassium also solidifies at this temperature. Since the solidifying-point of nitrate of sodium is -17° , this salt cannot exist without partial decomposition taking place in either mixture; for, as has been shown above, its presence would ultimately depress the solidifying-point.

Dr. RAE remarked that these researches are specially interesting in connection with the salts retained by sea-ice. With a view to studying this subject, he has already requested captains of whalers visiting the Arctic Regions to bring home samples of ice of different age, and from various localities.

PROCEEDINGS
OF THE
SOCIETY OF PUBLIC ANALYSTS.

THE following discussion followed the reading of Dr. Dupré's paper on the "*Natural Constituents of Wine,*" which appeared in our last number:—

Dr. REDWOOD—Dr. Dupré having referred to a certificate of mine relating to wine having been used for advertising purposes, I have no hesitation whatever in saying, that I constantly feel heartily ashamed of seeing my name blazoned forth as it is in connection with the advertisement in question, and I can assure you that its being so used has been no fault of mine. In giving certificates of analyses to persons who are engaged in business, and who, I have every reason to suspect, would be likely to use any report that I might give in the shape of an advertisement, I have always made it an invariable rule to stipulate with them that my certificate is not to be so used. In reference to the case in point, a gentleman called at the Pharmaceutical Society, and upon stating that he wanted an analysis, was referred down to me, and he stated that his object was to get a sample of wine analysed; and I undertook to make the analysis, and stated what my fee was, which is my usual fee in such cases. In due course my report was given. I gave him what I considered to be a fair and good analysis, suitable for the circumstances. His statement to me was that he simply wanted to satisfy his own mind and the minds of his friends that the wine which had been offered to him was a wholesome and good wine. I never was more surprised in my life, than when some months or so afterwards I found this report of an analysis of mine appearing as an advertisement.

Dr. MUTER—I should like to ask the opinion of Dr. Dupré as to a process for the detection of foreign colouring matters in wine, on which I have been making experiments in wine lately with a good deal of success. I dare say you know of the method—that of removing the albumen, and afterwards taking a test for the colouring matter in the filtrate from the precipitate.

Dr. STEVENSON—I am very glad that Dr. Redwood has had an opportunity of giving the explanation he has given, and of explaining how the trick was played upon him. It is very satisfactory to find that there is such an explanation of the circumstances under which the certificate was given. I think, myself, that we ought to set our faces against such a use of certificates, and especially as medical men, against recommending wines for certain dietetic purposes. Dr. Dupré is perhaps pre-eminent above all in this country and abroad on the subject of wines. He has paid exceeding attention to this subject, and I hope that he will give in his paper, which will appear in print, the whole of the details as to all these facts and figures with regard to wine. They are somewhat difficult, of course, to follow, as they are read out here, but they are so valuable, that I hope he will give as ample details as he possibly can. And as to that very important subject—the ratio of one constituent to another in the wine—I cannot too much express my gratification that we have had such a paper, which will form one of the most valuable contributions to the first number of the Journal of the Society.

Mr. CLEAVER—With regard to the presence of tartaric acid in wine, it seems to me that it is almost impossible for so much tartaric acid to be in wine in the state of tartaric acid, as there are potash salts present. They would

WEIGHT IN GRAMMES OF SOME OF THE CHIEF CONSTITUENTS OF 1 LITRE (1000 C.C. OR 1000 VOLUMES)
OF THE UNDERMENTIONED WINES.

Particulars of Wines Analysed.	Specific Gravity.	Absolute Alcohol.	Free Fixed Acid in Tartaric Acid.	Free Volatile Acid in Acetic Acid.	Total Free Acid in Tartaric Acid.	Real Tartaric Acid.	Total Dry Residue.	Grape and Fruit Sugar.	Total amount of Ash.	Carbonate of Potassium.	Sulphates and Chlorides.	Phosphate and Car- bonate of Calcium.	Total amount of Phosphoric Acid.	Alcohol in Fixed Ethers.	Alcohol in Volatile Ethers.	Total Alcohol in Ethers found.	Total Alcohol in Ethers calculated.	Proportion per cent of Alcohol found to Alcohol calculated.
Doz. Vintage.																		
Hock, white 30s. 1862	993.43	95.6	3.48	0.57	4.20	—	18.63	—	1.95	0.58	0.76	0.60	0.32	0.132	0.230	0.362	0.360	100.5
" " 40s. 1859	993.48	92.0	4.20	1.14	5.62	2.550	18.55	0.12	1.70	0.07	0.78	0.85	0.30	0.199	0.239	0.438	0.458	95.7
" " 120s. 1857	992.81	104.4	4.31	0.93	5.37	0.675	20.60	1.12	1.45	0.14	0.46	0.85	0.35	0.225	0.239	0.464	0.493	94.3
Claret 15s. 1865	995.58	85.3	4.24	1.47	6.08	0.675	21.40	4.31	2.08	0.66	0.95	0.48	0.33	0.155	0.197	0.352	0.476	74.0
" 48s. 1865	995.03	120.0	4.24	1.74	6.41	1.875	24.33	2.04	2.25	0.66	1.05	0.55	0.30	0.186	0.248	0.430	0.581	74.6
" 66s. 1861	994.73	85.3	3.23	1.80	5.43	1.838	18.00	0.95	2.00	0.38	0.99	0.63	0.30	0.166	0.216	0.382	0.429	88.8
Hungarian, red 21s. ..	992.07	113.6	3.56	2.49	6.68	0.600	20.85	1.47	1.85	0.41	0.91	0.53	0.35	0.151	0.358	0.509	0.656	77.6
" white 34s. ..	992.88	95.4	5.33	1.47	7.16	0.675	18.20	0.61	1.75	0.14	0.81	0.80	0.25	0.186	0.271	0.457	0.613	74.5
" " 42s. ..	993.09	94.9	4.74	1.80	6.99	0.375	18.13	0.24	1.88	0.12	0.90	0.85	0.25	0.162	0.273	0.435	0.596	73.0
Greek wine " 20s. ..	994.56	107.2	3.41	3.00	7.16	0.675	25.30	2.00	2.25	0.07	1.18	1.00	0.25	0.224	0.214	0.438	0.690	63.6
" " " 28s. ..	992.25	124.5	4.54	1.68	6.64	—	24.42	1.12	3.05	0.41	2.01	0.62	0.25	0.384	0.179	0.563	0.707	79.6
" " " 36s. ..	993.17	138.9	2.33	1.77	4.54	0.300	25.50	3.64	3.75	0.21	2.49	1.05	0.45	0.245	1.207	0.453	0.530	85.1
Sherry 22s. 1865	994.09	172.0	2.70	1.53	4.61	0.187	42.00	25.65	4.50	0.07	3.63	0.80	0.18	0.206	0.216	0.422	0.639	66.1
" high price 1860	997.93	178.1	3.08	1.68	5.18	0.262	53.50	29.70	5.50	0.18	4.41	0.95	0.25	0.290	0.391	0.681	0.749	90.8
" " 1857	998.30	184.0	2.81	1.62	4.84	0.150	56.44	35.10	5.13	0.07	4.18	0.88	0.13	0.262	0.469	0.731	0.722	101.2
Madeira, E. I. 60s. ..	993.94	177.5	3.26	1.68	5.36	0.300	43.47	20.80	3.90	0.27	2.52	1.10	0.42	0.305	0.382	0.687	0.774	88.7
" high price 1812	994.15	180.0	4.20	3.27	8.25	—	45.41	16.29	3.59	0.17	1.93	1.49	0.50	0.460	0.773	1.233	1.207	102.1
Port 32s. 1864	1004.76	185.6	3.08	0.84	4.13	0.225	75.57	43.31	2.48	0.48	1.34	0.65	0.35	0.302	0.128	0.430	0.620	69.4
" high price 1854	997.42	175.3	3.54	1.07	4.83	0.225	53.90	22.84	2.58	0.66	1.37	0.55	0.33	0.351	0.220	0.571	0.697	84.9
" " 1842	986.95	182.6	2.66	1.08	4.01	0.150	31.01	10.10	2.10	0.69	0.86	0.45	0.33	0.283	0.331	0.614	0.595	103.2
Marsala 16s. old	996.65	167.1	1.88	1.11	3.26	—	49.83	32.40	2.25	0.21	1.54	0.50	0.18	0.256	0.189	0.445	0.447	99.3
" 20s. very old	999.65	168.9	2.25	1.38	3.98	0.150	57.48	37.60	3.13	0.55	1.92	0.65	0.23	0.333	0.216	0.549	0.550	99.8

form tartrate of potash, which would be insoluble in the alcohol, and it stands to reason that there would be no tartaric acid present.

Dr. DUPRÉ—Certainly.

Mr. WANKLYN—I should like to say a word about the ash of wine. I believe that, if the ash of most of the wine in this country be examined, it will be found to consist almost entirely of sulphates. A while ago I examined the ash of some Rhine wine, and I found it consisted almost entirely of sulphates. Where wine is not treated with sulphate of lime, it is usually, I believe, treated with sulphurous acid, and we must not expect to find the ash of wine to consist of much else than sulphates.

Dr. DUPRÉ.—I have just a few words to say. First of all, I am very glad that Professor Redwood has given that explanation. As regards the certificates, I must confess that I have never any difficulty about the matter. I have been for many years engaged in the analysis of wine. I have published, in conjunction with Dr. Thudichum, a very large work on wine, and have been very frequently referred to on the subject; but I invariably make it a point to write to the man, whoever he may be, and ask him to give me a written engagement or letter that the analysis should be used only for his own private personal information. I believe that there is nothing which is more detrimental to us as analysts than to see these certificates constantly put forward as a kind of intimation that the profession of the analyst is not quite so high and honourable a one as it might be. I think that, as analysts, we have a very high function to perform on behalf of the public. We have, on the one hand, to ensure that the public gets only a pure article, and, on the other hand, we have to defend the honest trader, that he may not be put into competition with the trader who makes use (to put it mildly) of trade tricks. The certificates are nearly always made use of for such purposes. With regard to the matter mentioned by Mr. Wanklyn, I have stated in the paper, which must of necessity have been a short one, that even pure natural wines frequently contain no chlorides or carbonates, as the wine has been sulphured; but I have always pointed out the great distinction between sulphuring and plastering. The sulphuring increases the sulphuric acid, but not materially the ash; but plastering increases not only the sulphates but the ash, simply because the one is done only to

finished wine. It leaves sulphuric acid, and it leaves the cream of tartar of natural wine just as insoluble as it was before. The cream of tartar is thrown down, whereas the sulphuring which is done to the must changes the cream of tartar into sulphide of potassium. With regard to the question asked by Mr. Cleaver, it is almost invariably the case that the tartaric acid present in a wine is present as bitartrate of potassium, and the amount is nearly always proportional to the solubility of the bitartrate in the wine at the lowest temperature to which that wine may have been subjected; so that if the wine had been exposed to cold, it would contain less acid than before. I have frequently had from Spain samples of acid wine, which have been exposed during winter here, and which gave a considerable deposit of bitartrate of potassium. Such a wine, of course, afterwards contains less bitartrate; but that is not always the case. I have found some wines in which there was a considerable excess of bitartrate as measured. It appears that the riper the grape, generally speaking, the greater is the amount of tartaric acid contained in it. In conclusion, I have been extremely glad to hear the explanation of Dr. Redwood that he objects as strongly as I always object to these certificates.

Dr. Dupré then handed in the table inserted above, showing the proportions of the constituents of the various wines referred to therein.

WE have just perused with considerable interest the Thirteenth Annual Report on "Unsound and Adulterated Food," presented by Dr. Cameron, Public Analyst for Dublin, to the Lord Mayor and Corporation of that city.

It appears that during the year 1874 Dr. Cameron analysed 385 samples, of which he found no less than 220 to be adulterated. This proportion (being about 62 per cent) strikes us as being remarkably high, as compared with the general results in England, and it is perhaps worth noting that Dr. Cameron's analyses in Ireland in 1874 disclose just about the same proportion of adulteration as did the investigations of Dr. Hassall in England in the years 1851 to 1854.

As in most other places, milk appears to be in Dublin the article to which the adulterators devote the greatest attention. Dr. Cameron examined 232 samples, and

only found 65 of them pure. Mustard, too, seems to be subject to much sophistication, as of 31 samples 22 were mixed with various foreign substances, cayenne pepper being used to give pungency. Amongst other articles, Dr. Cameron analysed coffee, tea, cocoa, sugar, pepper, soda, confectionery, bread, brandy, whisky, wine, and porter. Strange to say, Dr. Cameron finds no adulteration in the article of butter. In this respect, he is more fortunate than most analysts on this side the Channel have been, as butter in England has not been found remarkable for its purity; and we fear that in some cases we have been guilty of the injustice of crediting our Irish friends with sending us some of the worst samples.

Thirty-seven prosecutions were instituted under Dr. Cameron's certificates, all of which were successful, the total amount of fines imposed, with costs, being £150.

Dr. Cameron supplements his report with a list of the names and addresses of the persons convicted, and the amounts of the individual penalties. He also adds some remarks on the Bill now before Parliament, in which he animadverts on some of the defects to which we have repeatedly called attention. Amongst other things, Dr. Cameron objects to the "exception" which allows of the sale of mixtures which are the subjects of patents, and he says:—"A patent has been taken out for converting chicory-root into a form in which it simulates the appearance of coffee-berries; and, consequently, if the Bill become law, such spurious coffee-berries may be legally vended. Another patent has been taken out for the purpose of mixing coffee and chicory, and I am aware that the mixture has been largely sold under the name of patent coffee."

We gather from Dr. Cameron's figures that adulteration, since the passing of the Act of 1872, has been on the decrease in Dublin; but it is still so extensively practised that we can only wonder to what proportions it might have grown if the original intention of the Government to confine the operation of the new Bill to England had been adhered to.

THE "Sale of Food and Drugs Bill," which has been twice recently on the order-paper of the House of Commons, has on both occasions been postponed, and cannot now come on for consideration till after the Easter holidays.

MILK AND THE ADULTERATION ACT.

At the Society of Arts, on the 17th inst., Mr. Wanklyn delivered a lecture with the above title. The lecture consisted, first, of a *resume* of the usual process of milk-analysis as described in his well-known little book on that subject, and, secondly, of a criticism on the present Adulteration Bill now before the House of Commons.

We noticed the following novelty, or at any rate a novel mode of statement, in the course of the lecture. The lecturer said that whole milk, skim-milk, and cream exhibit only one point of analytical difference, they contain different proportions of fat; but the ratio between the water in them and the "solids not fat" is the same, viz., 90.09 : 9.65. The practice of watering is recognised by the alteration of this ratio. Mr. Wanklyn proposed that the milk-trade should adopt the term, half-skim, and openly sell milk under that designation. In Switzerland, half-skim is recognised and sold.

NOTICES OF BOOKS.

Cholera: How to Prevent and Resist it. By Dr. MAX VON PETTENKOFER, President of the Sanitary Commission of the German Empire. Translated by T. W. HIME, A.B., M.B., &c. London: Baillière, Tindall, and Cox.

The translator, in his introduction, reminds us that each time the cholera has visited Europe, it has shown a greater

reluctance to depart. Since 1865, it has occurred to a greater or less extent in various parts of Europe; and though England has, so far, escaped, there is no knowing how long this immunity may continue.

Yet, with such a prolonged warning before our eyes, we are taking scarcely any steps to avert or even diminish the danger of an attack. Our sanitary knowledge, imperfect as it is, is still far in advance of our practice.

Dr. Pettenkofer's work calls attention to certain points bearing upon public health which have been generally overlooked. We are by this time alive to the importance of keeping our houses well ventilated. We have heard, also, much discourse,—partly rational, but partly foolish, exaggerated, and sensational,—anent our water supply; and through the mistaken kindness of the Registrar-General we have become familiar with the awful and misleading notion of "previous sewage contamination." But the general public assume, in Dr. Hime's words, "that the atmosphere ends where the ground begins." Professor Pettenkofer's great merit as a sanitary authority consists in his having pointed out, and proved by striking experiments, that the soil or ground on which our houses are built is pervaded by air and water. "A very compact gravel will consist of pores or air-holes to the extent of one-third of its bulk. . . . New well-baked bricks will absorb (each) as much as half-a-pint of water; a compact sandstone suitable for building purposes will, in a short time, absorb from five to six times of its own weight of water." That air when rarefied by a rise of temperature tends to ascend is, of course, a familiar fact. During the greater part of the year our houses are at a higher temperature than the external atmosphere. Consequently, they act as chimneys, or ventilating-shafts, through which the air in the ground under and around their foundations will rise upwards. If such air is tainted with the emanations of cesspools, grave-yards, sewers, and putrescent organic matter generally, the consequences to the health of the inmates are self-evident. The evil is further intensified by the fact that the outside ground immediately adjacent to houses is often rendered air and water-tight by a coating of asphalt. In this case, the soil under the house offers less resistance, and naturally becomes the course of the upward current. This evil might, we think, be very much diminished if all ground under houses and all the subterranean walls were likewise well cemented with asphalt, or some similar body.

Along with "ground-air" we have to deal also with "ground-water." The conclusions arrived at by the Cholera Commission of Bavaria, in 1854, were "that epidemic cholera only occurred in places situated on porous ground, permeable to air and water, and in which water could be found at a moderate depth, and that places situated on impermeable soil (rock, &c.), were not visited by cholera at all, or only in isolated cases." "A clay soil resting on limestone gravel, through which the water never rises sufficiently high to reach the clay, is unsusceptible to cholera, a fact which has been often noticed in different places, as well as in Munich during the epidemics of 1836 and 1854. In Munich, Haidhausen, and Berg, the epidemic of cholera confined itself to the houses situate on the gravel, and avoided in the most striking manner those on the more elevated clay." This law which, of course, applies as well to typhoid and other zymotic diseases, accords ill with the preference so heedlessly given to gravel soils as the supposed best locality for dwellings. True, a gravel soil, if perfectly unpolluted, and if not traversed by currents of foul water, has its sanitary advantages. But how rarely are such conditions fulfilled, especially in urban and suburban localities!

The following passage calls for the most serious attention of sewage irrigationists and of "intermittent downward-filtrationists":—"The soil has a certain power of rendering decomposing substances harmless, but, like everything else, this has a limit."

We feel sure that every attentive reader of this work will agree with us in pronouncing it a most valuable contribution to sanitary literature.

CORRESPONDENCE.

DISSOCIATION OF NITRIC ACID.

To the Editor of the Chemical News.

SIR,—Allow me space to correct an error in the report of the paper on "Dissociation of Nitric Acid," read before the Chemical Society on the 4th inst.

In the third series of experiments it is stated that nitric acid containing nitrous acid was *not* decomposed on boiling, the reverse being the case. Nitric acid containing 0.123 per cent of N_2O_3 yielded 0.3 c.c. of gas, that containing 1.28 per cent yielded 2 c.c. of gas of which 71 per cent was oxygen; but nitric acid containing no nitrous was boiled to dryness without any decomposition occurring.—I am, &c.,

PHILIP BRAHAM.

6, George Street, Bath,
March 17, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 7, February 15, 1875.

New Researches on the Mode of Intervention of Electro-Capillary Forces in the Phenomena of Nutrition.—M. Becquerel.—Desirous of ascertaining the physico-chemical action exerted by water and salt-water upon tubers and fruits, the author has made several series of experiments, which lead to the following results:—Water is constantly positive, and the fruit or the tuber negative, which indicates that the electro-capillary currents have the effect of oxidising the parts under the epidermis or the skin. With saline water the result is inverse. We see hence the effects which may be produced in living bodies by the introduction of different liquids, effects which should be taken into consideration in the application of the physico-chemical sciences to medicine.

Depth and the Superposition of the Magnetised Layers in Steel.—M. J. Jamin.—The magnetic strata are limited to a certain thickness, which they can never exceed. This limit varies in different steels. It is very great in those which are soft, and diminishes as the proportion of carbon augments and as the temper is harder. For certain bars which the author has studied it is $= 0.004$; but he has specimens where it is below 1.10 m.m. The latter only receive what might be called a superficial magnetic coating, the thickness of which it is not possible to augment by increasing the intensity of the current. But if the depth of the magnetisation diminishes along with the magnetic conductivity, the intensity of the magnetism increases. It follows that the quantity of magnetisation is subject to two causes of inverse variation—the depth which increases, and the intensity which lessens as the conductivity increases.

Certain Mechanical Properties of Saturated Steam.—M. C. Antoine.—Between the temperature, the tension, and the volume of steam we may establish certain relations of great simplicity. If we designate the temperature of the steam in degrees C by t ; the maximum elastic force of the steam, in atmospheres, by p ; the same elastic force

expressed in centimetres of mercury by F ; and the volume of a kilogram. of steam in litres by V , then—

$$(1.) pV^{1.1} = 3538.$$

$$(2.) pV = 135 \sqrt{t} + 55.$$

If we calculate the temperatures, setting out from 55° below the zero of melting ice we have, on designating these new temperatures by T ,—

$$(3.) PV = 135 T^{0.50}.$$

The elimination of V from the equations 1 and 3 gives—

$$(4.) P = \left(\frac{T}{155} \right)^{5.5} \text{ and } F = 76 \times P = (0.014175 \times T)^{5.5}$$

The elimination of P in the equations 1 and 3 gives—

$$V = \left(\frac{685.8}{T} \right)^5 \text{ or } V = 0.1517 \left(\frac{1000}{T} \right)^5.$$

Bulletin de la Societe Chimique de Paris,
No. 1, January 5, 1875.

Action of the Chlorides of Alcoholic Radicals on the Secondary Monamines.—M. Ch. Girard.—Allow to react in cast-iron enamelled autoclaves, or in tubes, for ten to twelve hours at 200° to 250° C., 100 kilos. diphenylamin, hydrochloric acid (sp. gr. 1.17) 68 kilos., and pure methylic alcohol 24 kilos. The pressure may amount to 10 to 15 atmospheres. The mixture when cold is decanted, treated with soda, and distilled. The methyl-diphenylamin which distils over is still contaminated with a little diphenylamin, which is removed by treatment with twice the volume of concentrated hydrochloric acid and agitation. The mass becomes hot, and on cooling deposits hydrochlorate of diphenylamin in crystals. These are thrown on a filter, and the liquid hydrochlorate of methyl-diphenylamin is decomposed with water, and then neutralised with soda. The boiling-point of the purified methyl-diphenylamin is 282° C. To prepare ethyl-diphenylamin, 30 to 32 kilos. of ethylic alcohol are used instead of the methylic directed above, the proportions of diphenylamin and of acid remaining the same. It is an oily liquid, and distils over at about 295° to 297° . It is coloured violet by nitric acid, and forms a crimson solution in water. It yields dyes with many oxidising agents. Amyl-diphenylamin is prepared and purified like its two lower homologues. It is likewise of an oily consistence, and distils at 330° to 340° . Nitric acid produces with this base a blue-slate colour, resembling that given by diphenylamin. All these bases can be transformed into blue dyes by heating with oxalic acid from 120° to 130° for fifteen to twenty hours. The yield of colour is very abundant. The tinctorial bodies formed are freed from excess of base by successive treatment with benzol, ether, petroleum, and alcohol, in which last liquid these blues are unfortunately very sparingly soluble. Pure diphenylamin is also converted into a blue dye by the same treatment, as proved in 1866 by the author and M. de Laire, and may be purified in the same manner. It is more soluble in alcohol than the blues produced from the tertiary monamines. These dyes may, however, be obtained in a state soluble in water by heating either diphenylamin or the tertiary monamines with a mixture of oxalic and sulphuric acids, at temperatures not exceeding 140° . The soluble blue dye, thus prepared, is easily freed from any excess of base. Advantage is taken of the different solubility of the calcareous salts of the sulpho-conjugated acids produced in the reaction, those of the blue compound not having the same properties as those of the secondary and tertiary monamines. The sulpho-conjugated acids of diphenylamin readily reproduce this base.

Action of Chlorine on Perbromide of Acetylen.—M. E. Bourgoïn.—The final result is the same whether these substances are allowed to react in sunlight or in darkness: the hydrogen and half the bromine are replaced by chlorine.

New Treatment of Commercial Nickel so as to obtain a Pure Sulphate of Nickel, without the use of Sulphuretted Hydrogen or of Ammonia.—M. A. Terreil.—The salts of nickel employed in the electro-deposition of that metal are prepared from commercial nickel, which is an alloy of nickel, copper, and iron, with traces of arsenic, containing from 40 to 90 per cent of actual nickel. The author's process consists of four operations—solution of the crude metal in acids; precipitation of the copper by iron; peroxidation of the iron, and conversion of the metals into sulphates; precipitation of the iron by carbonate of baryta, and crystallisation of the sulphate of nickel. The nickel is first dissolved in seven to eight times its weight of aqua regia; the solution is evaporated almost to dryness; the residue is re-dissolved in water, using about five times the weight of the nickel employed. A little arseniate of iron remains insoluble, and is removed by filtration. Metallic iron, preferably small nails, is introduced into the hot liquid, to about the weight of the nickel employed. It is stirred from time to time to detach the copper from the iron. As soon as a piece of bright iron, introduced into the liquid, is no longer coated with copper, this process is complete. The whole is thrown on a filter, and washed repeatedly. The copper is then collected by sifting it under water, in a sieve coarse enough to let pass the coppery metallic powder, but retain the iron. The copper is dried, and is then marketable. The filtrate now contains merely nickel and iron. The latter is peroxidised, either by a current of chlorine, or by treatment with nitric acid. Sulphuric acid at 66° B. is then added in the proportion of 2 parts to 1 of nickel employed, and the whole is evaporated to dryness to expel nitric and hydrochloric acids. The dry residue is re-dissolved in water, a part sometimes remaining insoluble, consisting of sub-sulphate of iron. From the solution the iron is thrown down by means of carbonate of baryta (artificially precipitated). This carbonate separates the iron as sesquioxide, and forms at the same time insoluble sulphate of baryta, without acting upon the sulphate of nickel. The last traces of arsenic are thrown down along with the sesquioxide of iron. The precipitation is effected by gradually adding a slight excess of carbonate of baryta to the liquid, slightly heated, but not so as to exceed 50° to 60°. It is complete when a further addition of carbonate occasions no effervescence, and does not become covered with peroxide of iron. Pure sulphate of nickel then remains in solution. It is separated from the precipitate by filtration, and the filtrate is evaporated till a pellicle appears on the surface, when it is set aside to crystallise.

Reaction of Bromide of Ethylen on Dilute Alcohol in Presence of Acetic Ethers of Glycol.—M. E. Demole.—Not adapted for abstraction.

Determination of Albumen by Tannin.—The determination of albumen by a standard solution of tannin does not give correct results, since all kinds of albumen do not combine with the same proportion of the reagent. Thus, that found in Bright's disease retains 37 per cent of tannin, but that met with in accidental cases of albuminuria, only 28. To determine albumen by means of tannin, it is necessary to add to the albuminous liquid, half its volume of a solution containing 26 per cent of common salt. Solution of tannin is added till all the albumen is thrown down. The whole is filtered, washed with water till free from salt, the tannin removed by means of boiling alcohol, and the residue dried and weighed.

Preparation of Magenta without Arsenic.—M. Bibanow.—The author has tried Nicholson's process, heating 3 parts of aniline (quality for red) with 1 part of hydrochloric acid at sp. gr. 1.16, and 1 part nitric acid at sp. gr. 1.42, to 180° to 200°. The result was not satisfactory, the mass quickly turning to a dirty violet. He next tried double salts of heavy aniline and of chloride of zinc. The experiment was made with a mixture of 120 grms. of heavy aniline; 100 of hydrochloric acid at 1.16; 30 grms. of nitric acid at 1.43; and 90 c.c. of zinc chloride in solu-

tion (1 grm. of zinc in 1.5 c.c.), heated to 186°. In this case, also, the result was a dirty violet. The author then treated the double chloride of pseudo-toluydin and zinc with nitrate of aniline, heating to 140° to 160° with a little free aniline to promote fusion. The proportions were—

8 parts $\text{ZnCl}_2, 2(\text{C}_7\text{H}_9\text{N})$,
1 part $\text{ZnCl}_2, 2(\text{C}_6\text{H}_7\text{N})$,
6 parts $\text{C}_6\text{H}_7\text{N}, \text{HNO}_3$.

The results were satisfactory as to shade, but the author could not fix the yield. 20 grms. of nitranilin, with 10 grms. pseudo-toluydin, and 5 of aniline, yielded also a magenta of fine tone, but in small quantity.

Quantity of Neutral Fatty Bodies Remaining in Fats after Saponification.—M. Birnbaum.—Fats are saponified industrially either by water under pressure, or by dilute sulphuric acid in open vessels. The quantity of neutral fat remaining after industrial saponification is estimated by the quantity of glycerin set free by the action of caustic potash. An indigenous tallow, heated with water for ten hours at 14 atmospheres, and then saponified with potash, yielded 0.094 of glycerin in 8.355 parts, corresponding to the following percentage composition:—

Water	0.26
Neutral fats	10.90
Free fatty acids	88.57
	<hr/>
	99.73

A grease from New York, treated seven hours at 14 atmospheres, and then re-treated, gave—

	First Treatment.	Second Treatment.
Water	0.38	0.11
Neutral fats.. .. .	14.37	13.08
Free fatty acids	85.17	86.11
	<hr/>	<hr/>
	99.92	99.30

The results obtained by saponification are much more perfect, as shown by the following analysis of a grease thus treated:—

Water	0.12
Neutral fats (?)	99.53
Ash.. .. .	0.03
	<hr/>
	99.68

Preparation of Colourless Crystalline Carbolic Acid.—M. Schnitzler.—Raw phenate of soda is strongly heated in a copper still. Water, naphthalin, oils, and a little carbolic acid pass over, and the fire is removed when the distillate begins to run milky: 15 kilos. require about ten hours. The greater part of the carbolic acid remains combined with the soda as a solid mass. The temperature of the vapour, during distillation, may reach 170°. The solid residue is afterwards dissolved out in triple the quantity of water necessary. This liquid is allowed to settle for some days, when certain impurities are deposited. Dilute sulphuric acid is then added to the clear liquid, the carbolic acid is decanted and distilled in glass vessels. Water passes over first, then pure carbolic acid, which crystallises entire; and, lastly, a less pure carbolic acid, which, even after crystallisation, retains some oily impurities.

Reimann's Farber Zeitung, No. 4, 1875.

This number contains an article on the prejudice against green tarletans, which, as non-technical papers assert, are got up with Schweinfurt green—a powerful poison. The editor shows that this arsenical preparation is now superseded by Guignet's green, which is perfectly safe.

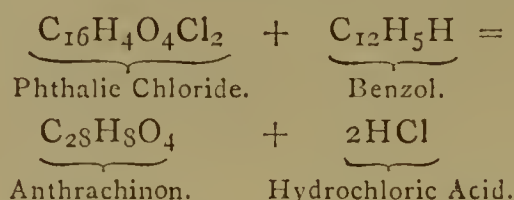
There are receipts for a green for calico; for dyeing felts; and for a logwood blue on cotton yarns.

Burning petroleum can be extinguished by adding to 1-60th part of chloroform.

No. 5, 1875.

Dyers in Berlin and other parts of Germany complain of the stringent regulations of the sanitary police. They are compelled to run their effluent waters into large tanks and to purify them with lime—a process which certain experts have pronounced impracticable upon the large scale.

Manufacture of Alizarin.—The manufacture of alizarin has hitherto been checked for want of the raw material, since anthracen, which is converted first into anthrachinon and then into alizarin, is found only to a small extent in coal-tar. There is now a prospect of obtaining the raw material in quantity. Phthalic acid, $C_{16}H_4O_6$, is produced by oxidising naphthalin. Benzol, $C_{12}H_6$, is well known to be an abundant constituent of coal-tar. If the chlorine compound of phthalic acid, $C_{16}H_4O_4Cl_2$, is heated for twelve hours with benzol to $220^\circ C$. in a closed vessel, anthrachinon is obtained according to the following reaction:—



This process is proposed by Piccard, and will, it is hoped, soon be introduced into practice.

There are receipts for printing a green and white pattern on a dark blue ground; for a finish for cottons; and a bright reddish blue on wool, in two methods.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved process for the preservation of meat, fish, and other articles of food, and similar perishable substances. Claudius Stibbard Clark, Hind Street, Poplar, Middlesex. May 23, 1874.—No. 1837. The said invention relates to the preservation of meat, fish, poultry, game, and other articles of food, and similar perishable substances by treating them with a liquid or solution of bisulphite of lime, limestone crystallised sugar or other saccharine matter, saltpetre, and common salt.

Improvements in the production of nitric acid. Eustace Carey Prentice, of the firm of Prentice, Brothers, Stowmarket, Suffolk. May 25, 1874.—No. 1841. This invention consists, first in the admixture and incorporation with the nitrates, such, for example, as the nitrate of soda, or with nitrate of potash, to be decomposed by means of sulphuric acid for the purpose of effecting the production of nitric acid, of oxidising agents; such, for example, as the chlorates. Chlorate of potash, for example. Permanganates or manganates of the alkalis, or of the alkaline earths, or the peroxides; for example, the peroxide of manganese. Chromic acid, the chromates and the bichromates of the alkalis and of the alkaline earths, and of such metallic oxides and compounds as shall, by the action of sulphuric acid and by the presence of the lower oxides of nitrogen, be capable of elevating the same from a lower to a higher degree. Secondly. Or instead of adding to the nitrates either of soda, potash, or lime the whole or a portion of the oxidising agents necessary to convert the lower oxides of nitrogen into the higher oxides or into nitric acid, I add such oxidising agents to the sulphuric acid to be employed for effecting the decomposition of the nitrates, and employ such admixture for effecting the decomposition of the nitrates, and for the production of nitric acid. Thirdly. The employment of oxygen in a pure or in a concentrated form, such, for example, as that obtained by the heating of peroxide of manganese and chlorate of potash, in admixture with the products which are evolved in the production of nitric acid from nitrates by the action of sulphuric acid upon the same. Fourthly. The employment in the production of strong nitric acid of an intermediate or secondary vessel containing sulphuric acid, in conjunction with any of the before-mentioned oxidising agents, so as to effect the conversion of the lower oxides of nitrogen into the higher, and thereby increase the yield of the nitric acid. Fifthly. The employment of any of the before-mentioned oxidising agents in conjunction with nitric acid, containing the lower oxides of nitrogen, so as to convert the same into the higher oxides, or into nitric acid. Sixthly. The treatment by the admixture of any of the before-mentioned oxidising agents, of a mixture of nitric acid and of sulphuric acid resulting from the production of gun-cotton or from other sources, such acids containing organic or other matters or compounds as cause the decomposition of the nitric acid upon the application of heat.

Improvements in the manufacture of artificial yeast-powder and prepared flour of a self-raising character. John Henry Johnson, Lincoln's Inn Fields, Middlesex. (A communication from Edward Peers Eastwick, New York, U.S.A.) May 26, 1874.—No. 1846. This invention consists in the manufacture of a new compound to be used

in connection with any kind of flour or amylaceous matters intended for culinary purposes. The said compound or mixture is composed of neutral and acid salts in the proportion and for the purpose hereinafter more fully specified. The chemicals which may be used are the carbonates (acid or neutral) of the alkalis and alkaline earths, soda, potassa, ammonia, lime, &c., and the neutral or acid or double sulphates of alumina (alums), or any other salts which by their decompositions precipitate alumina, and by which alums may be formed, and sulphates (of the carbonate used) and free carbonic acid gas are produced. A mixture of two or more carbonates and a sulphate or other salt of alumina can be used, and will give a similar reaction as when only one carbonate is used.

Improvements in ebullioscopes. Alexander Melville Clark, patent agent, Chancery Lane, Middlesex. (A communication from Pierre Marie Edouard Malligand, and Marie Euphrésine Elizabeth Brossard-Vidal, both of Paris.) May 29, 1874.—No. 1885. This invention relates to various improvements in instruments known as ebullioscopes, or ebullition alcoholometers. (1) To maintain the liquid in a constant condition during the whole time of testing. (2) To provide means for reading off the mercurial column with greater precision. (3) To verify the accurate calibration of the thermometer. (4) To provide an accurately calibrated mercurial thermometer. (5) To a method of graduating ebullioscopes of any description. (6) To heating the ebullioscope in detail, instead of directly, so as to obtain perfect regularity [in the boiling-point of each liquid*]. (7) To provide a deflector for preventing the tumefaction of the alcoholic liquids during their ebullition. (8) To immerse the bulb of the thermometer in the steam of the boiling water instead of in the water itself, so that the latter may not affect the result.

Improvements in the treatment of phosphates of lime, and in the production of valuable products thereby. Benjamin Tanner, F.C.S., North Strand, Dublin. June 2, 1874.—No. 1915. This invention consists in certain improvements in the treatment of phosphates of lime whereby valuable products are obtained in an economical manner, and of such character and composition as may be desired. Any of the ordinary forms of phosphate of lime of commerce, or any other form of phosphate of lime, or any mixture thereof, is or are heated with hydrochloric acid, and solutions thereof obtained. The solutions obtained as before mentioned are treated with sulphuric acid in such quantity as to combine with the whole or any part of the lime or calcium in the solution, whereby the latter is precipitated in the form of sulphate of lime, and then separated by known means. The liquid portion is again employed as a solvent for the phosphate of lime, and the treatment with sulphuric acid repeated, the lime or calcium removed, and the liquid portion again employed as a solvent for phosphate of lime, the resulting solution being evaporated in furnaces. The relative proportions of lime or calcium and phosphoric acid having been ascertained, sulphuric acid is added to the mass, so as to leave, approximately, for every 71 parts of phosphoric acid 28 parts of lime or 20 parts of calcium. The dry product is useful as a manure. Instead of employing sulphuric acid as before mentioned, either of the alkalis, or their salts in conjunction with sulphuric acid, may be employed. The dry product will contain, in addition to the phosphate of lime, salts of the alkali or alkalis. Phosphoric acid of any desired degree of concentration is obtained according to the number of times the acid liquor is caused to dissolve any of the forms of phosphate of lime, and is subsequently mixed with sulphuric acid in such proportion as to combine with the whole of the lime or calcium present, and the solution may be treated with alkalis or alkaline salts. The character and composition of the products are regulated by the proportions of the phosphate of lime and the acids, alkalis, and alkaline salts.

Improved apparatus for extracting greasy and fatty matters from various waste substances. William Edward Newton, civil engineer, Chancery Lane, Middlesex. (A communication from Frederick William Ralph, Brussels, Belgium.) June 4, 1874.—No. 1951. The object of this invention is to produce a simple and inexpensive apparatus in which bisulphide of carbon may be used for dissolving out and extracting fatty and oleaginous matters from various waste substances, such as cotton-waste, which has been used for wiping and cleaning machinery from the oil that will become spilled thereon. The apparatus which forms the subject of the present invention is so constructed and arranged that the escape of the bisulphide of carbon is practically impossible; and when it has been separated by distillation or otherwise from the fatty matters, it can be used over and over again.

MEETINGS FOR THE WEEK.

TUESDAY 30th.—Civil Engineers, 8.
WEDNESDAY, 31st.—Society of Arts, 8.
THURSDAY, April 1st.—London Institution, 7.
— Chemical, 8.
FRIDAY, 2nd.—Geologists' Association, 8.

TO CORRESPONDENTS.

W. Greaves.—(1) Girard et de Laire's book is not published in English; (2) the CHEMICAL NEWS is the only journal likely to contain information on the subjects you name.

W. L.—Your "Solar Speculations" are mere speculations, with no proof or authorities. What reason have you for saying that heat and gravitation are convertible into one another?

M. L.—Our rule is not to insert letters unless we know the writer's name and address.

* The words "in the boiling-point of each liquid" are found in the copy of the Abridgment delivered by the applicant, but do not appear in the original Abridgment.

THE CHEMICAL NEWS.

VOL. XXXI. No. 801.

ON THE LIQUATION, FUSIBILITY, AND DENSITY OF CERTAIN ALLOYS OF SILVER AND COPPER.*

By W. CHANDLER ROBERTS, Chemist of the Mint.

THE author states that the most remarkable physical property of silver-copper alloys is a molecular mobility, in virtue of which certain combinations of the constituents of a molten alloy become segregated from the mass, the homogeneous character of which is thereby destroyed. These irregularities of composition have long been known, and reference is made to them in the works of Lazarus Erckern (1650), and of Jars (1774). A very complete memoir was published in 1852 by Levol, who did much towards ascertaining the nature and defining the limits of this molecular mobility. He discovered the important fact, that an alloy containing 71.89 per cent of silver is uniform in composition. Its chemical formula (Ag_3Cu_2) and peculiar structure led him to conclude that all other alloys are mixtures of this, with excess of either metal.

The electric conductivity of these alloys was studied in 1860 by Matthiessen, who doubted the accuracy of Levol's theory, and viewed them as "mechanical mixtures of allotropic modifications of the two metals in each other."

The author then described the experiments he made with a view to determine the melting-points of a series of these alloys. He adopted Deville's determination of the boiling-point of zinc (1040°C.) as the basis of the inquiry, and ascertained by the method of mixtures the mean specific heat of a mass of wrought-iron between 0°C. and the melting-point of silver, which, as Becquerel showed, is the same as the boiling-point of zinc.

The mean of three experiments, which were closely in accordance, gave 0.15693 as the specific heat; and it should be pointed out that this number includes and neutralises several errors which would affect the accuracy of the subsequent experiments.

The melting-point of each alloy was then determined by plunging an iron cylinder into it and transferring the iron to a calorimeter. These melting-points varied from 840°C. to 1330°C. , or through a range of 490°C. The alloys which occupy the lowest portion of the curve contain from 60 to 70 per cent of silver. The results are interesting, as they show that the curves of fusibility and electric conductivity are very similar.

The author states that, in studying the phenomena of liquation, the alloys were cast in red-hot moulds of fire-brick in which the metal (about 50 ozs.) could be slowly and uniformly cooled. The results showed that the homogeneity of Levol's alloy is slightly disturbed by this method of casting; and, on the other hand, that alloys which contain more than 71.89 per cent of silver hardly shows signs of rearrangement, when the solidification is gradually effected. Two alloys were examined, which contained 63.0 and 33.3 per cent of silver respectively. Both were found to be far from homogeneous. In the case of the former the arrangement was influenced by gravity, the base of the casting being rich in silver.

The density of pure silver and of Levol's homogeneous alloy, while in the fluid state, were then determined by the method described by Mr. Robert Mallet†; the metals being cast in conical vessels of wrought-iron. The results obtained were as follows:—

	Density fluid.	Density solid.
Pure silver	9.4612	10.5700
Levol's alloy	9.0554	9.9045

* Abstract of a paper read before the Royal Society.

† *Proc. Roy. Soc.*, vol. xxiii., p. 209.

In the case of silver, the mean linear expansion deduced from this change of density is 0.00003721 per 1°C. , which is nearly double the coefficient at temperatures below 106°C.

REDUCTION OF METALLIC OXIDES BY HYDROGEN, AND APPLICATION TO THE DETECTION AND QUANTITATIVE DETERMINATION OF METALS.

By W. MÜLLER.

IN a previously published series of experiments (*Poggendorf Ann.*, 136, p. 51), I have shown that the reduction of the oxides of platinum, gold, silver, mercury, copper, lead, antimony, arsenic, tin, nickel, cobalt, iron, and manganese, by means of hydrogen, depends on the temperature, in so much that each oxide is acted upon by hydrogen from a certain degree of heat upwards. This degree was found constant in all experiments with one and the same oxide, but differed for every metallic oxide examined. Even the modifications of certain oxides, in case of tin and mercury, could be thus distinguished. In connection herewith, I have tried how far it is possible, by maintaining the temperature at a certain point, to determine quantitatively the ingredients of a mixture of metallic oxides. As previously, the reduction was performed in an elbow-shaped tube, the shorter and fused-up limb of which contained the oxide, and was heated in a sand or paraffin bath; whilst the other open limb was plunged into water or mercury. The disappearance of $\frac{1}{4}$ c.c. of hydrogen, equivalent to less than 0.2 milligram oxygen, could thus readily be observed. In all the oxides the remarkable fact was perceived that after some time—in one case, *e.g.*, after an hour—the reduction was manifestly slackened, so that in spite of the much smaller quantity of oxide now present, a distinctly smaller percentage of oxygen was given up to the hydrogen in the same time. This retardation of the process of reduction is not caused by a molecular change of the oxides in consequence of the heat, since prolonged application of heat previous to reduction is without influence on the duration and course of the process. Nor is it due to a change in the hydrogen, for a bulb-tube containing the oxide, and continually traversed by fresh hydrogen, showed the same reaction. Nor does it spring from the particles of reduced metal mixed with the oxide, since oxide of mercury, whose metal is deposited away from the oxide, shows the same phenomenon. As a higher temperature is not required for removing the last residue of oxygen, I was led to the supposition that, with the same absolute distance of oxygen and metal in the oxide, the reduction-movement of adjacent particles produced a new arrangement of the two elements which hinders the action of hydrogen gas. This phenomenon is of more general occurrence. According to the observation of L. Bell (*CHEMICAL NEWS*, vol. xxiii., pp. 258, 267), the reduction of metallic oxides by carbonic oxide takes a similar course. H. Rose, in his "Manual," when speaking of the separation of cobalt and manganese by reducing chloride of cobalt with hydrogen gas, refers to the difficulty of completing the reaction. In the behaviour of zinc, copper, tin, lead, and mercury, when heated in the air, the difficulty of converting the last traces of metal into oxide seems to be a kindred phenomenon.

Since the reduction takes up a long time, it was necessary to examine whether by prolonged heating of oxides even below their reduction-point, a perceptible quantity of hydrogen might not be taken up. Oxide of copper was heated for 14 hours, 50° below that temperature, and oxide of lead for several days, 100° below the point, in contact with hydrogen, without any action. At this temperature, therefore, the oxides may be regarded as undecomposable. If heated up to a temperature near the reduction-point, and observed for an hour, a decrease of

the hydrogen was observed, augmenting more and more as the temperature rose. Since, however, an important action only takes place at the point of reduction, the determination of oxides, according to the proposed method, remains practicable, and the examination of the several determinations was undertaken.

The mixture of oxides was obtained either by precipitation from mixed solutions, or by evaporation and ignition of the nitrates. Heat was applied to the reduction-tube by means of a sand-bath, with a thermo regulator. The experiment is completed when the height of the water closing the open limb of the tube remains constant.

The result of the experiments was as follows:—

1. Copper and zinc. End of the experiment after 5 hours; found 0.034 grm. oxygen of the copper oxide. Calculation required 0.0338 grm.
 2. Copper and silver. Duration 45 hours; found 20.9 instead of 20.5 milligrms.
 3. Copper and bismuth. 26 hours; 20.2 instead of 20 milligrms.
 4. Copper and cadmium. 22 hours; 28.4 instead of 28.5 milligrms.
 5. Copper and lead. 45 hours; 19.2 instead of 18.8 milligrms.
 6. Copper and tin. 9 hours; 12.3 instead of 12.4 milligrms.
 7. Silver and iron cannot be determined, their oxides forming a chemical combination.
 8. Silver and lead could not be determined.
 9. Arsenic and antimony could not be determined.
 10. Mercury and iron. 25 hours; 19.6 instead of 20.5 milligrms.
 11. Copper, iron, and zinc. 10 and 26 hours; 17.5 instead of 17.6 and 16.8 instead of 16 milligrms.
 12. Copper, cadmium, and zinc. 12 and 2½ hours; 24.2 instead of 25.2, and 11.2 instead of 10.9 milligrms.
 13. Copper, tin, lead, and zinc, could not be jointly determined, though it was possible to determine copper, tin, zinc and copper, lead, zinc.
 14. Copper, manganese, iron, and zinc. The method was found inapplicable.
- It appears that oxides, even when jointly precipitated from a solution, remain uncombined.—*Berichte der Deutsch. Chem. Ges. zu Berlin.*

ESTREMADURA PHOSPHORITE.

By Dr. B. C. NIEDERSTADT,
Sworn Commercial Chemist.

For the last two or three years a mineral substance containing phosphoric acid, and used as manure, has been imported to our market from Spain. It is found in the province of Estremadura, especially in the neighbourhood of Logrosan, and is obtained by mining. It appears in the market in pieces, the size of a fist, knotty, and is hard as stone, of a yellow-reddish colour.

It is found in considerable quantities; and the facility of importation to Hamburg has rendered it an extensive import article, amounting in the year 1872 to 11,000 kilos., and more than 100 cargoes have already been imported. This mineral is greatly to be preferred to Lahn phosphorite (which contains 3 to 6 per cent iron oxide, and 1.5 per cent aluminium oxide), because, in consequence of the trifling quantity of the materials above mentioned, it is not exposed to the risk of the phosphoric acid becoming insoluble, which is generally the case.

The percentage of phosphoric acid, as shown in various investigations, is considerably reduced by a preponderating quantity of quartz; and scarcely amounts to 28 per cent, as proved by various experiments.

When compared with the most valuable sorts of guano—such as Baker, Curacao, and Bolivia—which contain

more than 34 per cent phosphoric acid, this contains fully 6 per cent less. While, therefore, the latter furnishes a superphosphate of 14 to 16 per cent dissolved acid, the value of the phosphorite must be correspondingly inferior, according to the analysis.

The superphosphate has a crumbling, dry form. The quantity of carbonate of lime varies greatly, sometimes amounting to even more than 20 per cent, and the analysis therefore requires a greater quantity of acid. The results of the various analyses were:—

"Porto Packet."

Phosphate of lime ..	54.691	Phosphoric acid	25.052
Phosphate of magnesia ..	7.010	" "	3.798
Carbonate of lime ..	8.065		
Sulphate of lime ..	1.200		
Iron oxide	0.621		
Aluminium oxide ..	0.165		
Fluoride of calcium ..	1.520		
Manganese	trace		
Silicic acid	25.720		
Water	0.250		

99.242 Phosphoric acid 28.350

"Maria Sophia."

Phosphate of lime ..	62.352	Phosphoric acid	28.653
Phosphate of magnesia ..	1.605	" "	1.026
Carbonate of lime ..	13.688		
Sulphate of lime ..	2.440		
Iron oxide	0.528		
Aluminium oxide ..	0.985		
Fluoride of calcium ..	1.204		
Silicic acid	16.412		
Water	0.175		

99.389 Phosphoric acid 29.679

"Catharina."

Phosphate of lime ..	57.369	Phosphoric acid	26.280
Phosphate of magnesia ..	0.708	" "	0.383
Carbonate of lime ..	7.385		
Sulphate of lime ..	1.599		
Iron oxide	0.453		
Aluminium oxide ..	0.405		
Fluoride of calcium ..	1.822		
Silicic acid	29.428		
Water	0.790		

99.959 26.663

"Stamboul."

Phosphate of lime ..	59.594	Phosphoric acid	27.300
Phosphate of magnesia ..	3.977	" "	2.155
Carbonate of lime ..	13.327		
Sulphate of lime ..	0.858		
Iron oxide	0.910		
Aluminium oxide ..	0.427		
Fluoride of calcium ..	0.983		
Manganese	trace		
Silicic acid	19.164		
Water	0.721		

99.961 Phosphoric acid 29.455

Hamburg, March, 1875.

ON THE MANUFACTURE OF CAUSTIC SODA.*

By JOHN MORRISON, F.C.S.

(Continued from page 135.)

THE third branch of my subject I am compelled to treat very superficially. I need not enter into the composition of the vat liquors. Those from the causticiser stand from 14° T. to 16° T., and contain about 4½ per cent alkali, and 0.15 per cent sulphide, together with sulphite, hyposul-

* A Paper read before the Newcastle-upon-Tyne Chemical Society.

phite, and sulphate of soda; also chloride of sodium, with traces of other compounds.

For several reasons it is important that the lime used in causticising should be of first-rate quality. Some of the inferior or impure varieties of Welsh, Derbyshire, or Lancashire limes, produce a bad settling liquor, so that it rarely pays to employ them, even though procurable at a very cheap rate. The limes of the Buxton Lime Company, and those of Messrs. Kneeshaw, Lupton, and Co., Abergele, are, I think, the best at present to be got into Widnes.

The lime mud on the filters almost invariably contains about 50 per cent moisture. The variation in the best samples rarely exceeds 5 per cent, whether the filtration has been effected with a vacuum or without. Consequently, it would appear that the air pump simply augments the rapidity of filtration, but does not really increase the dryness of the mud, even though—as it generally does—the mud which has been filtered by means of a vacuum underneath the bed appears firmer and less pulpy than mud filtered simply by gravitation. When the mud has been cast from the filter “beds,” however, it rapidly dries under the influence of the atmosphere.

It seems practically impossible to remove all the soda from this mud; and beyond a certain point, washing has apparently no effect. An average sample of properly treated magma contains about $2\frac{1}{2}$ per cent alkali, in the dry state, representing $1\frac{1}{4}$ per cent in the condition in which it leaves the filter beds. And as about 11 cwts. good burnt lime are consumed per ton of 60 per cent caustic soda, producing say 36 cwts. mud, the total amount retained would be 50 lbs. alkali per ton of 60 per cent caustic soda, or about $2\frac{1}{4}$ per cent. Supposing, however, we have a weak lime to deal with, and consume 20 cwts. per ton of caustic soda produced, this would give us, say 3 tons mud, representing a loss (supposing always the amount of alkali withheld to remain the same) of 84 lbs. Na_2O per ton of caustic soda, or nearly 4 per cent; and this, to say nothing of the extra labour involved in its utilisation in the black-ash furnaces. The above loss, of course, assumes that none of the soda is recoverable in the black-ash furnaces, which for all practical purposes is taken for granted, although my own impression is that 30–50 per cent reappears in the balls.

It was some years ago proposed by Muspratt to expel the water and carbonic acid from the mud by calcination, and so to use the lime over and over again; and though it is just possible that the regenerated material might be less energetic than the freshly burnt lime from the kilns, the experiment seems worthy of a trial. So far as I know, however, the suggestion has never assumed a practical shape. Perhaps by moulding into bricks, and calcining in an ordinary fire brick kiln, it would be possible, in a sufficiently cheap way, to revivify the mud completely. And its utilisation in some such way would, of course, effect an important diminution in the loss of alkali, as well as reducing the consumption of the lime itself.

Next in order come the “fished salts” from the boat pans. These, after draining, contain as follows:—

Moisture	18.00
Na_2CO_3	39.00
NaHO	9.00
Na_2SO_4	29.00
NaCl	0.50

With hyposulphite and sulphite of soda.

In appearance they are like dirty white sand. There are about 2 tons of dry salts to each batch of 10 tons of caustic soda produced, and which continually carry back into process, on the above approximate analysis, nearly 5 cwts. of caustic soda, together with 18 cwts. carbonate, and 13 cwts. sulphate soda. These salts are practically innocent of sulphides if a little nitre has been added to the liquor in the boat pans.

This much, however, cannot be asserted of the pot-

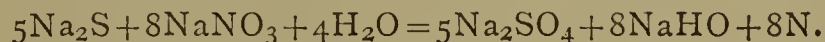
settler “fishings.” If a sample of them be dissolved in water, a green solution will at first be the result, but if this be allowed to remain exposed for a day or two to the action of the atmosphere, it will become quite colourless, owing to the oxidation of the sulphides present, and the deposition in a granular state of the iron held by them in solution.

The “bottoms” amount to 9 to 11 per cent of the caustic soda produced, and without they fetch a pretty good price in the market, it pays best to re-dissolve and work them up again. They are sometimes sold on a basis of 54 per cent, and so much per degree over that margin; but more generally at a price 54 per cent being guaranteed. When the latter is the case, they may be reduced to the requisite strength with fished salts. They originally vary considerably in strength, and if a pot be salted after it has settled well, they will test higher in alkali than the supernatant caustic, but if it be salted either before or immediately after nitreing, they will show less alkali. They usually contain a little lime, 3–4 per cent peroxide iron, and 5–6 per cent aluminate and silicate soda, besides the carbonate and caustic soda, and chloride and sulphate sodium.

The pots previously to oxidation contain $1\frac{1}{2}$ to 2 per cent sulphides, or about 35 lbs. per ton, to convert which into sulphate 29 lbs. of oxygen are necessary, this amount being represented by about 56 lbs. nitre. The latter, however, is in excess of the amount regained, showing that during the oxidation process other resources must be drawn upon to complete the reaction. The decomposition may be stated as follows:—



or at a higher temperature:—



The amount of nitre actually used is 40 to 45 lbs. to the ton of caustic soda, and in the case of air, 25 to 30,000 cubic feet are generally sufficient with good liquor. Simultaneously with the destruction of the sulphides, the iron held by them in suspension separates as peroxide.

At the temperature at which the oxidation is commenced, no sulphite or hyposulphite will be present, those having previously broken up to form sulphate and sulphide, so that we have probably only sulphides to deal with. Could we by any practicable method precipitate the sulphur as a metallic sulphide, and gain by that means an equivalent of caustic soda, we should of course be able to augment somewhat our present strength of available alkali; but no method so far as I am aware—unless indeed it be in the single works at St. Helens (the Greenbank Alkali Company) in which 76 per cent (Hudson’s test) is manufactured—is practised with this view, although the reverse process was in use a few years ago in the small “Bachêt” experimental works at Walker, where it was attempted to manufacture caustic soda from common salt directly, by reacting upon it with litharge, and where M. Bachêt was accustomed to precipitate the lead unavoidably present in his caustic liquors with solution of sulphide sodium. For practical purposes it is estimated that half the weight of nitre used is returned in the usually (but not always) more valuable shape of caustic soda, so that when nitre is cheap, and caustic high, it pays best to adopt it as the oxidising agent in preference to a blast of air; but when nitre is “up,” and caustic depressed, blowing is the cheaper. Whether of the two methods to adopt, therefore, is at all times—given the prices of caustic soda and of nitre, and the cost of blowing—easy to calculate. Nitreing reduces the amount of total available alkali from 1 to 2 per cent, blowing a little more. Blowing, as I have previously remarked, requires more pot room than nitreing, and it is also inadmissible in the case of cream caustic, the finishing temperature being too low.

I have spoken of the care necessary on the part of the workmen towards the close of the oxidation process to prevent the batches becoming green. This discolouration

is supposed to be due to manganese derived from the lime, and which appears to exist in presence of sulphides as a lower oxide, but simultaneously with the destruction of the last trace of sulphide to be converted into manganic acid, which immediately laying hold of a portion of soda, forms manganate of soda. At first a very delicate shade of green is produced, but if fresh additions of nitre be made, the colour will speedily become extremely intense or almost black. Prolonged maintenance at a high temperature will also, but much more slowly, bring about a similar reaction.

I need hardly allude to the graphite or the ultramarine, which appear in the final stages of the caustic soda process, possessing as they do but little practical interest. The former is probably formed by the decomposition of the cyanides, and ferro and sulphocyanides, some or all of which are invariably present in vat liquors, and are carried right through the process till their final destruction at the high temperature to which they are subjected when they go to form ammonia (the hydrogen being derived from the water present, the oxygen of which has been abstracted by the sulphides during their oxidation) which passes off, and graphite, &c. The latter is perhaps due to the formation, by the action in the "balling" process of the sulphides, &c., on the silica and alumina of the limestone, of uncertain compounds of silica, alumina, and soda.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, February 23, 1875.

R. ANGUS SMITH, Ph.D., F.R.S., &c., Vice-President, in the Chair.

MR. JOSEPH SIDEBOTHAM, F.R.A.S., sent for exhibition a specimen of the Colorado potato beetle (*Doryphora decom-lineata*), which had appeared in great numbers in Canada last year, and had caused great destruction in the potato crops.

Ordinary Meeting, March 9th, 1875.

EDWARD SCHUNCK, Ph.D., F.R.S., &c., President, in the Chair.

MR. ARTHUR McDougall, B.Sc., invited attention to a specimen of carbon formed upon the roof of a gas retort by the decomposition of the hydrocarbon gas by heat. The carbon thus formed resembles graphite in its almost metallic lustre, and it was suggested that its mode of formation might throw some light upon that of graphite. Graphite always occurs in association with rocks which have been subjected to igneous action, and may have been formed by hydrocarbon gases traversing fissures or dykes whilst the sides were in a highly heated state, thus causing a deposit similar to that formed in gas retorts. The fact that in the latter case an increase of pressure causes a greatly increased amount of deposit favours this view, as it is extremely probable that any gases existing in the earth's crust would be in a state of great tension.

"On the Presence of Sulphate of Copper in Water Heated in Tinned Copper Boilers," by WILLIAM THOMSON, F.C.S.

A few weeks ago I was consulted with regard to some water which was taken from a copper boiler in a kitchen range, which led me to investigate the case, and, as the results seem to be of vital importance to many, I venture to bring them before your notice.

The range referred to belonged to a large chapel in Manchester, and was employed for culinary purposes in connection with various meetings of the congregation, &c. It

was originally formed of two iron boilers, each capable of holding from 30 to 40 gallons, with a fireplace between. One of these boilers was cracked, through cold water having been carelessly thrown on the iron after it had been allowed to become nearly red-hot. To repair this defect, a copper boiler, coated with tin, was fitted into the cracked iron one. I was informed that this boiler, together with the iron one on the other side of the range, had been employed for heating water for tea-making at one or more meetings, and that some persons complained of feeling ill after tea. Some of the hot water from this boiler was afterwards employed for washing, and as it broke up the soap like hard water, and threw to the top a scum which had a bluish colour, suspicion was thrown on it, and a sample of the water brought to me for examination. It contained some matter in suspension of a dark colour, which soon subsided, and left the water clear. Presuming that if copper were present it would be in suspension and not in solution, I examined the sediment, but found it to be free from that metal. I then filtered and examined the clear water.

It contained a large proportion of copper in solution, and gave a distinctly acid reaction to blue litmus-paper. I evaporated the water down to a very small bulk, and extracted the free acid with absolute alcohol, eliminated the alcohol used, and got it in a concentrated form in a water solution: it charred paper with facility, and gave a copious white precipitate with chloride of barium insoluble in hydrochloric acid, thus proving it to be free sulphuric acid which had acted upon the copper. I then continued my investigation to find the source of that acid. I observed that the boilers on each side of the fireplace were supplied by the same water (Manchester supply), passing along the same pipe. I collected a sample of that water from the tap used for filling the copper boiler, and took another from the iron boiler on the other side: these samples were evaporated down and tested, but found to contain neither free acid nor copper. I next looked for the acid as a result of the combustion of sulphur in the coal, but as both boilers were entirely separated from the fire by brickwork, and also covered in on the top, the products of combustion had no chance of finding their way into the boilers; and, further, had this been the cause I ought to have found free acid in the water of the iron boiler.

On further enquiry, I was informed that after the boiler had been put in it was well washed with water, and afterwards had a solution of washing-soda boiled in it, and again washed well with clean water. After this treatment, water which was heated in it became highly contaminated with copper and free sulphuric acid.

My experiments up to this time having offered no solution of the problem as to how the water became contaminated, I made enquiries respecting the galvanising of such utensils, and found that the process followed was this:—The inside of the vessel was "pickled" with sulphuric acid, then rubbed with sand to remove oxide, and washed; lastly, heated up with chloride of ammonium, and block-tin rubbed over the surface.

The only explanation which I can offer of this remarkable contamination is, that part of the sulphuric acid used for cleansing before galvanising had been secreted in the joints formed by the riveting of the sheets of the copper together, and also between the plates and the rivets, so that when the boiler was washed and heated with a solution of carbonate of soda, it could not enter into the crevices to neutralise the acid during the few hours the soda solution was heated, but which, under the subsequent prolonged action of the hot water, gradually dialysed out, bringing the copper with it.

I called one day at the chapel, and found them using the hot water from this boiler for washing dishes, so that fresh quantities of pure water were being added as the hot water was drawn off. I took another sample of it, and on analysis I found it to contain 3.575 grains of metallic copper to the gallon, equal to 14.056 grains of crystallised sulphate of copper. I consider it well that results such as

these should be generally known, as I understand that boilers of this kind are often employed for culinary purposes, and through ignorance of the above facts serious results might accrue.

GLASGOW PHILOSOPHICAL SOCIETY.
(CHEMICAL SECTION).

Monday, February 15th, 1875.

Mr. JAMES MACTEAR, Vice-President, in the Chair.

MR. J. J. COLEMAN, F.C.S., read a paper "*On the Methods in Use for Testing Hydrocarbon Illuminating Oils.*" The author in the first instance compared, with some detail, the composition of Pennsylvanian crude petroleum with that of crude paraffin oil, in respect of the various products of distillation and the specific gravities of those which are liquid. His remarks were made chiefly in reference to the groups of hydrocarbons which, both in America and in this country, are isolated from the rest of the crude oil, and designated burning oils; and he said that the paraffin refiners had steadfastly adhered to the principle of separating all volatile hydrocarbons so carefully from burning oils intended for general use, that it would be difficult to find any sample of paraffin burning oil in the market that would give off inflammable vapour under 120° F., whilst the bulk of American petroleum-burning oils were so far contaminated with naphthas that it was very difficult to get a sample of imported petroleum which would not give off inflammable vapours at from 90° to 100° F., tested in the same manner as would result in a flash point of 120° for the paraffin oils. The habit adopted by the Scotch refiners in sending out *safe* oil was due to a regard to the public safety. When crude oil of either kind was deprived of its tarry, basic, and acid impurities by successive treatment with acid and alkali, the purified hydrocarbons were fractionated into groups, such as naphtha, burning oil, lubricating oil, &c., by the process of fractional distillation. By repeated distillations American petroleum is often broken or "cracked" up into—

Crude naphtha	..	20 parts
Burning oil	.. ..	66 "
Coke and loss	.. ..	14 "

100

This fact was shown by the author to have an important bearing in connection with the statistics of exportation of refined petroleum from America. While the amount shipped from America was on the average 356,908 tons per annum during the years 1866 to 1870, inclusive, it has latterly risen to an average of 705,200 tons per annum, Great Britain only taking about five per cent of the whole. Taking Dr. Chandler's average composition of crude petroleum, the refined products per annum during the last four years would be—

Naphtha	.. .. .	179,640 tons.
Heavy oil, containing a little paraffin	.. .. .	243,775 "
Gasoline	.. .. .	19,247 "

Considering that the whole animal and vegetable oil vended in Great Britain does not amount to 200,000 tons per annum, it would be difficult to conceive how the Americans disposed of 243,775 tons of heavy oil for lubricating purposes. In practice, however, they don't produce such a quantity of that material; they take advantage of the principle already referred to, that of "cracking" it up into burning oils of lighter specific gravity. It would be difficult, likewise, to conceive how they got rid of 179,640 tons of naphtha as naphtha. They do not export it in large quantities. During last year they only exported about 30,000 tons of naphtha, Great Britain getting one-half. But they got rid of it in the following manner:—1. By using the lighter portions for air gas; 2. By burning vast quantities of crude naphtha for heating purposes; 3. By putting as much as

they dare into the burning oil: and they are only stopped from going to an unlimited extent by the legislative acts of the foreign countries to which the material is exported. The specific gravity would not be materially affected, seeing that the light naphtha was added to an oil of heavy gravity; but at first sight the adulteration would not be detected. This irregularity, however, could be detected by fractional distillation, a system which was adopted by Mr. Valentin in 1871 with much success. After referring at some length to Valentin's experiments, the author proceeded to say that the Americans themselves had become thoroughly alarmed at the indiscriminate sale of dangerous burning oils in their own country, and that most exhaustive chemical reports had been made on the subject from time to time to the Board of Health Department of New York and to the Franklin Institute, no fewer than 639 samples being tested for the former body in 1869, of which only 21 did not give inflammable vapour at 100° F. In 1871, out of 100 samples tested only 7 were safe oils. These statistics, coupled with others in respect of the deaths from dangerous oils in the United States, and the fires in New York from the same cause, there had been legislation in many states of the Union,—the local Acts fixing various tests, such as from 120° F. down to 100° as a fire test; 100° F. as a vapour test; and 110° to 100° as a flash test. Mr. Coleman next described the Petroleum Act of 1871, and the subsequent attempts at legislation in this country on the same subject. He mentioned the chief provisions of the Act, and said that the weak point of the Act was the system of testing fixed by the Schedule; indeed, it was so indefinite that chemists obtained results differing from one another to the extent of even 10° or 15°. In concluding his paper, the author drew attention to the fact that a burning oil was most economical photometrically when deprived of its volatile matters, or naphtha, and therefore legislation on the subject could not have any effect in deteriorating the value of the American products. He said that, as chemists, the members of the Section would understand that the relative illuminating power of hydrocarbon illuminants was dependent upon their relative richness in carbon, which increased in proportion to the specific gravity of the oil. The question of burning illuminating hydrocarbons was a question of lamps, which should be so constructed as that there must be a sufficient amount of oxygen supplied to the flame. That condition had been perfectly attained; and paraffin oils, from their greater density and their less volatility than the average of American petroleums, had been proved to be photometrically more efficient in the proportion of about 13 per cent.

In illustration of remarks made in the course of his paper, the author enlarged upon the systems of testing, but he would not commit himself to any recommendation as to what the flash point should be in future. He also performed a number of experiments with different forms of lamps and wicks.

A long and interesting discussion followed the reading of the paper. A visitor said that there was a much greater quantity of the lighter hydrocarbons in crude petroleum than in crude paraffin oil, and hence there was much more trouble to get rid of them. The quantity was from 15 to 20 per cent as against 5 per cent. In answer to a question put by a member, he said that they were more difficult to separate in the first instance than if they had been separated and then added to heavy oils.

Mr. R. R. TATLOCK was surprised that some more exact method of testing mineral oils had not been devised, such, for instance, as the amount by weight a volume of the oil consumed at different temperatures and in a certain length of time. The difference of the rate of heating the oil had certainly some effect in determining the flashing or firing point, for the slower it was heated the longer it would be before it rose in temperature to, say, 100° F., and most of the volatile hydrocarbons would by that time have escaped. The speaker also referred to the

admixture of oxidisable oils with mineral oils, and considered the subject in its relation to spontaneous combustion and the question of fire insurance.

After some remarks by Mr. Nathaniel Dunlop and the Chairman,—

Mr. COLEMAN said that the method of testing suggested by Mr. Tatlock would certainly be the most scientific, but brokers and commercial people would scarcely accept of it. In answer to the Chairman, he said that circular wicks were preferable to flat wicks.

SOCIETY OF PUBLIC ANALYSTS.

ADULTERATION ACT, 1872.

JUST now, when the working of this Act is being so generally discussed, the following Table—showing to what extent and with what results it has been put into operation in different districts—may not be without interest. It is necessary to add that the list of places is not a complete one, as there are some where Analysts have been appointed from which we have no return; but it is sufficiently full to convey a fair idea of aggregate results.

Place.	Time that the Act has been in Operation. Mos.	Total number of Samples Analysed.	Number found to be Adulterated.	Number of Con- victions.	The Adulterated Samples included—					
					Milk.	Tea.	Mustard.	Butter.	Bread.	Coffee.
Hackney ..	21	198	28	13	7	1	3	2	—	—
Buckingham and Bucks }	—	22	3	—	2	—	—	1	—	—
Bedfordshire ..	21	570	42	20	5	4	12	5	7	5
Bristol ..	13	253	90	5	30	11	9	11	—	11
Wigan ..	16	58	11	2	6	—	—	—	—	3
Limehouse ..	19	169	15	5	3	—	4	—	4	—
West Sussex ..	20	48	2	—	—	—	—	—	—	—
Huddersfield ..	15	18	1	—	1	—	—	—	—	—
Kensington ..	8	140	25	20	16	—	2	1	—	1
Southampton ..	9	21	7	—	7	—	—	—	—	—
Worcestershire	27	246	68	—	45	5	15	2	—	—
Newcastle-on- Tyne .. }	27	275	93	14	74	3	—	—	—	1
Devonshire ..	12	58	28	—	—	6	10	—	—	8
Westminster ..	20	242	41	16	28	—	2	—	—	5
Londonderry ..	25	158	43	5	30	2	2	—	—	1
Bradford ..	9	114	24	24	10	—	2	—	—	—
Durham ..	14	58	10	1	8	2	—	—	—	—
Gateshead ..	15	92	38	20	30	8	—	—	—	—
St. Saviour's, Southwark }	10	128	36	23	22	—	—	—	—	—
Camberwell ..	25	545	68	66	59	—	1	1	5	—
Rotherhithe ..	9	45	6	—	5	—	—	—	—	—
Bermondsey ..	17	281	45	33	25	—	8	—	—	10
Lambeth ..	20	252	29	28	10	—	5	—	3	9
St. George's, Southwark }	20	92	22	21	10	—	3	1	—	5
Wandsworth ..	20	974	84	22	24	—	7	—	—	29
Isle of Man ..	23	140	33	25	—	—	—	—	—	—
Cheshire ..	26	587	164	96	—	—	—	—	—	—
Liverpool ..	30	368	117	60	—	—	—	—	—	—
Lincolnshire ..	30	1036	490	66	—	197	129	—	62	43
Somerset ..	12	2216	845	520	—	212	294	26	—	106
Manchester ..	15	75	12	7	—	—	—	—	4	—
Greenwich, Plumstead, & Woolwich }	16	701	84	—	48	12	4	—	11	6
N. Staffordshire	14	830	341	135	40	88	14	—	—	—
Landport ..	18	191	—	15	9	—	3	—	—	3
St. Pancras ..	25	570	79	23	56	5	—	—	7	6
Shoreditch ..	22	87	22	8	12	2	—	7	—	—
Surrey ..	23	1513	168	140	34	22	70	6	3	24
Ipswich ..	18	None	None	None	—	—	—	—	—	—
Colchester ..	12	1	1	None	—	—	—	1	—	—
Cornwall ..	18	None	None	None	—	—	—	—	—	—
Cambridge ..	12	2	1	—	1	—	—	—	—	—
Swansea ..	2	56	28	16	23	—	—	—	5	—
Montgomerysh.	12	17	6	—	3	—	3	—	—	—
Shrewsbury ..	12	7	3	—	3	—	—	—	—	—
Shropshire ..	30	26	5	2	2	1	—	—	—	—
East Suffolk ..	10	2	—	—	—	—	—	—	—	—
Brighton ..	12	114	14	6	8	—	—	6	—	—
S. Staffordshire	22	526	251	—	88	137	21	1	—	1
Wolverhampton	22	163	56	—	20	14	9	4	—	1
Birmingham ..	30	105	102	38	38	41	6	2	—	—
Leeds ..	19	270	32	18	15	3	—	—	1	—
Monmouth ..	24	9	2	—	2	—	—	—	—	—

Place.	Time that the Act has been in Operation. Mos.	Total number of Samples Analysed.	Number found to be Adulterated.	Number of Con- victions.	The Adulterated Samples included—					
					Milk.	Tea.	Mustard.	Butter.	Bread.	Coffee.
Cork ..	32	171	32	—	—	—	—	—	8	5
Reading ..	12	28	1	—	—	—	—	—	—	—
St. George's, Hanover-sq. }	16	154	51	—	—	—	—	2	—	33
Edinburgh and Leith .. }	20	126	35	11	—	—	—	—	—	—
Gravesend ..	12	10	10	1	—	—	—	—	—	—
Lewisham ..	21	123	18	17	14	1	1	—	—	—
Hampstead ..	12	39	1	—	—	1	—	—	—	—

NOTICES OF BOOKS.

Water Analysis as it Should and as it Should not be Performed by the Medical Officer of Health. By C. B. Fox, M.D., Author of "Ozone and Antozone." London: J. and A. Churchill.

THIS little book, with a title as lengthy as the name of some newly-discovered chemical compound, is an extension of a paper read by the author before the Norwich Meeting of the British Medical Association in August last. The author tells us that it "was not written for the instruction of *dummy* Medical Officers of Health, who receive £5 or £10 a year as a salary, with the understanding that they are to do nothing." We fear that the existence of such sham Health-Officers, appointed not to execute but to evade the sanitary laws, is an undeniable fact. The tacit "understanding" of which Dr. Fox speaks might, indeed, be difficult to prove. But when a gentleman accepts for such a sum duties which, if really performed, would engross perhaps half his time, it is but fair to infer that his functions are no less nominal than his salary. We could name a little town where, behind every dwelling, the cesspool and the draw-well stand in amicable propinquity, separated by at most six yards of gravel, shingle, and chalk. The "conscript fathers" of that town have appointed a Health-Officer at £10 a year, and we are certain that any display of conscientiousness or vigour on his part would lead to his dismissal at the earliest opportunity.

Dr. Fox has a threefold object in the book before us. He wishes "to induce all *real* Medical Officers of Health to adopt some one reliable method of water analysis, so that the results of the examinations of all might be comparable, to demonstrate to them the superiority of the Nessler process to any other," and to give them some of the results of his own experience. To all this no objection can be taken. Uniformity of method is absolutely necessary where a number of observers are working independently towards one common end. The ammonia (or Nessler) process may not be absolute perfection, but until some method which can be placed in competition with it, without utter absurdity, it is fully entitled to that preference which it receives from practical sanitarians throughout the civilised world.

As regards the permanganate of potash test, Dr. Fox furnishes some interesting facts showing its utter untrustworthiness. Enteric fever broke out at Ingatestone, and was confined to the market-place. The water of the public well, tested with permanganate of potash, gave no indications of impurity. The fever still spreading, the water was analysed by Wanklyn and Chapin's process, and condemned. The well was closed, and the inhabitants directed to a pure source of water, and the fever speedily disappeared. It was afterwards found that a "rotten drain" passed within two yards of the well. Another case, given by Dr. Parsons, is quoted from *Public Health*. Five persons, using a certain well, were simultaneously attacked with enteric fever. The owner of the well

refused to believe that the water could be at fault, because it was clear, scentless, tasteless, and did not decolourise Condry's fluid. Yet, on analysis, it showed 1.08 grs. of albumenoid ammonia per million grains, and "on examination it was found that the cesspool of a privy had overflowed into it." Two waters from neighbouring pumps were brought to the Health Officer in one of the south-western counties. On the faith of the permanganate test, he pronounced one pure and the other quite impure and unfit for use. To his no small discredit it was found that both pumps were supplied from the same well. For many more valuable chemico-sanitary facts,—wonderful in amount if we consider the small number of pages,—we must refer to the book itself.

We have great pleasure in recommending this excellent manual not merely to the body for whom it was primarily intended, but to members of town councils, local boards, &c. It may awaken them to truths which they are fearfully apt to overlook.

Of all places in the world, the reader would be least likely to look for an attack upon "Darwinian" views in a pamphlet on water analysis. Yet here it is, in the shape of a condemnation of Professor Tyndall's view, that "the typhoid poison cannot be spontaneously generated." This,—admitting the said poison to be an organism,—is a view more befitting an advocate of "special creation" than an evolutionist. Dr. Fox has proved himself capable of original research. He should, therefore, be above bringing charges of "materialism" against opponents. Let him leave such unknightly weapons to Belfast squads and canons of St. Denis.

Announcement of the Stevens Institute of Technology; A School of Mechanical Engineering, founded by Edwin A. Stevens, Esq. Hoboken, New Jersey. 1874.

ON the European continent, statesmen, well knowing how largely the prosperity and the power of a country turns upon its eminence in physical science, found and maintain universities, laboratories, libraries, and every appliance needful for the cultivation and diffusion of technological knowledge. In America, the princely liberality of private citizens more than atones for the inaction of the Government. By the will of the late Mr. Stevens, a sum of money not less than 650,000 dols. and a valuable plot of land in the city of Hoboken were left to trustees for the foundation and establishment of a school of mechanical engineering. Now with mechanical engineering we have certainly little to do. But the institution in question is most elaborately fitted up for the study of chemistry and of the higher branches of physics. Turning to the department of optics, we find that the new institution possesses the instruments of the late C. N. Bancker, of Philadelphia, "long known to men of science as the most extensive museum of optical instruments existing in any part of the world." There are two "spectroscopes by Browning, and one by Desaga, reflecting and refracting-telescopes of every system, an excellent Zentmayer microscope, and thirty-four complete instruments for the study and application of polarised light alone." The collections of magnetic, electric, and chemical appliances are on a corresponding scale of completeness.

The annual fee for each student will not exceed £20, which, if somewhat higher than the German scale, is not more than one-third the sum charged for a similar course of tuition in England.

Such things are being done in America, whilst we cleave to the "three R's" for the many, and to "longs and shorts" for the few. Can there be a shadow of doubt as to the final result?

Influence of Pressure upon Combustion.—M. L. Caillaud.—The dissociation of the gaseous carbides, and the aspect of the spectra, demonstrate that the temperature of combustion is increased by pressure, though this increase is not necessarily very great.

CORRESPONDENCE.

MANUFACTURE OF CAUSTIC SODA.

To the Editor of the Chemical News.

SIR,—In conjunction with many other workers upon this subject, I have looked anxiously forward for the completion of the papers by Mr. John Morrison to see what and all he really has to say upon the subject, and several of us not accrediting many of the statements in which Mr. Morrison's paper abounds (as managers and chemists of works making caustic soda) have met privately to discuss one or two of the points, and to try and discover where some of the extraordinary work, detailed in the paper alluded to, was carried on.

When the paper was read before the Newcastle-on-Tyne Chemical Society, we have all here wondered what sort of opinion the audience had of Lancashire workmen. To talk about 34 balls being a good double shift's work, is causing a deal of amusement here, especially when 14 to 16 balls, each containing 3 cwts. of salt-cake, 4 cwts. of lime mud, a quantity of limestone—to which the works' physician would probably append Q. S.,—and $1\frac{3}{4}$ cwts. of slack, is spoken of as the usual 12 hours produce.

It is always accorded to travellers that they have seen wonderful things, and we "Lancashire lads" are perhaps behind in that respect, with this exception—that we keep our eyes open to the real, trying to grasp the trade as a whole, and not individually, as we find those north and those south of us do. A Lancashire manager should know all the details of processes carried on at the Tyne, for in Lancashire is made ash both carbonated and caustic together with white and cream caustic soda.

Caustic ash and white caustic soda is the exception on the Tyne. The first we know is so, and Mr. Morrison tells us that the manufacture of the latter is almost entirely confined to the Lancashire districts.

In spite of this remark, which is a truism, we have managers come down here from the Tyne to teach our "young idea" how to make white caustic.

Mr. Morrison is genuine indeed, for, after dilating upon the superiority of practical experience over chemical reasoning and ability, he says—"This practical experience" (either our own or some one else's)—and we Lancashire lads are greatly of opinion, reasoning from the statement that the manufacture is confined chiefly to Lancashire, that it is "some one else's" experience which has been the germ or nucleus of all that has followed. We should not care about this migration from the north if the rash statements would be suppressed, such as we complain of in the present letter. Another case:—A manager has resigned his post. A Tyne man made an application for his post; he was taken round the works by the proprietor, and saw a caustic ash being drawn, containing 11 or 12 per cent of caustic alkali. He said, "Why do you allow the men to draw it so? We draw it 'like a ball of fire.'" It would be very interesting to see it drawn in that condition, but some one else's experience had been drawn from, and the manager returned, to say the least, a wiser man.

These statements do a deal of harm. Proprietors would perhaps say, "They draw 17 balls in Lancashire per 12 hours shift,—we must do the same;" when in fact they do not. Nearly 40 per cent of the alkali manufactured in Lancashire is made in St. Helens, and what is their usual thing? Twelve balls per day shift, and sometimes 13 in the night shift; and these balls mostly contain only $2\frac{1}{2}$ cwts. of salt-cake, or are one-sixth less in size than those mentioned by Mr. Morrison. These places, producing smaller balls, less number, and, consequently, a smaller turn-out, are paying most of them even now. Can Mr. Morrison say this of all the Widnes small works?

This letter would not have been written, had not Mr. Morrison dilated rather too freely against "philosophic

methods of reasoning peculiar to the chemist," and tried to elevate into its place that power "peculiar" to the brute creation—"instinct or intuition." Is there not as much philosophic reasoning in the true working of the theory and laws of heat? Is there not as much science about hydraulics and steam? Is there no philosophic reasoning relating to mechanism, or in the principles of mechanics? To sum up—what in this world works alone, and has one groove to run in without interference from anything else?

In a chemical manufacture, where chemical conditions and physical conditions run side by side, in, out, through, and commingling with, one another, what is the use of chemistry alone? It stands unsupported; but when propped up with the sciences, collateral and cognate, is like the house built upon the rock,—the winds of strikes and the storms of bad prices beat upon it, but it falls not, for it is founded on a rock.

Before concluding, another "Lancashire lad" wishes me to ask how Mr. Morrison came to know that "good white caustic soda from red liquors alone, is—almost an impossibility," seeing that a firm have made "good white caustic soda" from red liquors alone for some years past; but I am afraid that this manufacture will not improve while we have superintendents of processes describing chemical compounds as "salts," "sublime," "scummy sort of crust," instead of describing what they really are.—I am, &c.,

A LANCASHIRE LAD.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 7, February 22, 1875.

New Observations on the Nature of Alcoholic Fermentation.—M. L. Pasteur.—Reserved for insertion in full.

Ruthenium, and its Oxygenated Compounds.—MM. Sainte-Claire Deville and H. Debray.—Pure ruthenium is as sparingly fusible as iridium; and if heated in an oxidising atmosphere it burns with brilliant sparks, a smoky flame, and a decided odour of ozone. The authors submitted ruthenium to the action of oxygen in a porcelain tube, heated to a temperature a little higher than the melting-point of copper. Fremy's crystals were thus reproduced in very fine specimens, into which the whole mass of oxide was transformed, only a very small portion having been transported by sublimation outside the "boat" which it had filled. This observation connects the phenomena with the "apparent volatilisations" of which Troost, Hautefeuille, Ditte, and the authors have given numerous examples. These facts have been explained by the momentary production of an unstable compound, which is dissociated almost at the time of its formation. Hyper-ruthenic acid (RuO_4), the analogue of osmic acid discovered by Claus, is yellow, crystalline, but so unstable that its form has not been determined. It melts at 40°C ., and at 108° it is destroyed with explosion. When decomposed it yields strongly ozonised oxygen. Osmic acid, on the contrary, produced by the direct action of oxygen upon metallic osmium, may be maintained in the state of vapour without decomposition. Ruthenic oxide is not reduced by heat like the oxide of iridium. It is found along with iridium, iron, and even platinum in most precipitates and solutions which contain at the same time the two former metals. Iridium, especially, retains ruthenium with great tenacity. Mr. Matthey informs the authors that four or five repetitions of Claus's process do not always suffice to free iridium from the last traces of ruthenium.

Simultaneous Formation, in the Hot Springs of Bourbonne-les-Bains, of various Crystalline Mineral Species, especially of Antimonial Grey Copper (Tetrahedrite), Copper Pyrites (Chalcopyrite), Phillip-site, and Chalcosine.—M. Daubrée.

Action of Borax in Fermentation and Putrefaction. M. J. B. Schnetzler.—The author finds that borax in small quantity arrests fermentation and putrefaction, and prevents the development of low forms of organic life.

Ebullition of Sulphuric Acid.—A. Bobierre.—Noticed elsewhere.

Comparative Study of Gums and Mucilages.—M. Giraud.—The author's investigations have been principally directed to gum tragacanth. Mucilaginous bodies which swell up in water may be divided into three distinct groups. In the first of these is placed gum tragacanth, characterised by the presence of a body capable of giving rise to pectic compounds. To the second belong the mucilages not containing pectic principles, and characterised by the fact that even the weakest acids render them insoluble in water, such as the mucilage of quinces. The third class is free from pectic principles, and is not precipitated by dilute acids, but transformed rapidly, on the application of heat, into a matter comparable with dextrin, and into a saccharoid body. These different bodies present the following properties in common:—Under the influence of dilute acids they are transformed by heat into a sugar different from ordinary glucose, which crystallises readily, does not ferment, and has a greater reducing power than glucose. It belongs to the galactoses of Berthelot. The gummy principles comprised in the last two groups differ from gum arabic in all their characters. Gum tragacanth is sparingly soluble in cold water, and is far from giving, as is asserted, 30 to 50 per cent of soluble gum. The filtrate is a mixture of different bodies, and not a definite principle like arabine. If gum tragacanth is digested in the water-bath with 50 parts of water, after twenty-four hours all the gummy matter is transformed into soluble gum, having lost the property of swelling up after drying. This new matter is not arabine, but pectine. Submitted to the action of acidulated water (1 per cent), it is modified in the water-bath in about three hours, becoming totally soluble. The new body produced is pectine, precipitable by alcohol. The amount of glucose formed during this reaction scarcely corresponds to a tenth part of the material employed. Hence it appears that gum tragacanth contains more than half its weight of a pectic principle insoluble in water, and probably identical with Fremy's pectose.

Examination of the Whey of Luchon.—M. F. Garrigon.

Determination of Boracic Acid.—M. A. Ditte.—If it be required to determine boracic acid contained in a solution in which it is contained alone, or in combination with alkaline oxides, a little ammonia is added to the liquid in order to neutralise any free acid, and then an excess of a saturated solution of pure chloride of calcium. All the boracic acid is then found as borate of lime, as a gelatinous precipitate, soluble in heat in chloride of calcium in excess. The matter introduced into a platinum capsule may be then evaporated to dryness without the least trace of boracic acid being volatilised. When dry, the crucible is filled with a mixture in equal equivalents of pure, crystalline chlorides of sodium and potassium, and heated moderately at first, and then to fusion. The borate of lime, much less fusible, collects at the bottom of the crucible in a spongy matter more or less agglomerated, and dissolves partially in the melting saline mass. If at the bottom of the crucible a temperature is maintained higher than in the upper part, the dissolved borate of lime crystallises on the surface of the liquid, and forms a ring, which rises along the side of the crucible, just above the surface. Soon all the borax is conveyed into this ring, and nothing remains at the bottom of the crucible. The composition of the crystals is BO_3, CaO . They are insoluble

both in hot and cold water. A cold concentrated solution of alkaline chlorides does not affect them; if hot, it dissolves a very small quantity. The matter, when cold, is separated from the crucible, and treated with cold water, when the chlorides dissolve. The crystals are washed on the filter, dried, detached from the filter, and weighed. Care must be taken not to fuse the amorphous borate of lime which occupies the bottom of the crucible in an early stage of the operation. The temperature of the bottom of the crucible should be kept as high as possible short of such fusion. The crucible cannot be heated with a Bunsen burner, but with a gas blast-lamp. On approaching the point at which the borate of lime is fused, the volatilisation of the alkaline chlorides becomes visible. There should be 1 part of pure dried chloride of calcium for 3 parts of the mixture of alkaline chlorides.

Microzymas and Bacteria, in reference to a Remark of M. Balard.—M. A. Bechamp.—A reply to the paper in *Comptes Rendus*, lxxix., p. 1272, November 30, 1874.

Butyric Fermentation Produced by Aquatic Vegetation Immersed in Solution of Sugar.—M. Schützenberger.

Phenomena of Diffraction Produced by Circular Net-Work.—J. L. Soret.—Not adapted for abstraction.

Berichte der Deutschen Chemischen Gesellschaft zu Berlin
No. 17, 1874.

Isomeric Dibrombenzols.—V. Meyer.—The author establishes the difference between the nitro-dibrombenzol of Meyer and Stüber, and that of Riese.

Constitution of Certain Substituted Benzols.—C. Wurster and E. Nölting.—The authors describe the preparation of tetra-brom-benzol from tri-brom-aniline, and discuss its supposed constitution.

New Property of Glycerin.—R. Godeffroy.—Already noticed.

Correction.—Eugen Demole.—In the author's method for preparing glycol (*Berichte*, No. 8, p. 641, 1874) the alcohol should be used, not at 80, but at 91 per cent.

Formation of Paralactic Acid by Fermentation.—R. Maly.—In the author's experiments on the formation of lactic acid by the action of the mucous membrane of the stomach upon various sugars in dilute solution, a small quantity of paralactic acid was simultaneously formed in many, though not all, cases. Its presence was proved by the analysis of the zinc salt.

Contributions to the History of Cyan-Acetic and Malonic Acids.—J. van't Hoff.—This paper relates to the action of bromine upon cyan-acetic acid, to ethyl-malonate of potash, and chloro-malonic ethyl-ether.

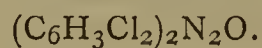
Dissociation of Sulphate of Copper.—Alex. Naumann.—If a crystal of blue vitriol is exposed, in the vacuum of Hofmann's apparatus for determining the density of vapours, to the temperature of the vapour of boiling alcohol, if the crystal is sufficiently large in comparison with the size of the vacuum, a few spots become white, especially those which receive which the heat first by contact with the mercury or the side of the glass tube. As the increase of the tension becomes gradually slower and slower, the white spots extend, and arise on parts of the crystalline surface previously unattacked. But even after an hour's observation the tension still increases, whilst the white of the parts first attacked becomes a dirty or greenish white, and the crystal is affected to a greater depth. If the crystal is small the whole surface is at once attacked, but becomes gradually darker again as the tension of the vapour rises.

Preliminary Communication.—W. Spring.—If oxychloride of phosphorus is cautiously added to well cooled chlorite of potash a yellowish green gas escapes, which is readily absorbed by water or potash-lye, but no chlorous acid or chlorite of potash is regenerated, but hypochlorous acid or hypochlorite of potash. The gas was proved not to be chlorine.

Derivatives of Guanidin.—M. Nencki.—The author describes formoguanin, its nitrate, hydrochlorate, and double platinum salt; choracetate of guanidin and guanolin.

Colouring Matters of Urine of the Indigo Group, and on Pancreatic Digestion.—M. Nencki.—Reserved for insertion in full.

Action of Alcoholic Potash-Lye upon Dichlor-Nitro-Benzol.—A. Laubenheimer.—The result of the reaction is chiefly tetra-chlor-oxazo-benzol,—



1,3 Dichlor-Benzol and its Derivatives.—Otto N. Witt.—The author examines 1,2,4 dichlor-aniline, dichlor-aniline-chlor-hydrate; 1,3 dichlor-benzol, dichlor-nitranilin, dichlor-nitro-benzol, and dichlor-phenylen-diamin.

Dinaphthyl-Methan and some of its Derivatives.—Julijan Grabowski.—An account of dinaphthyl-methan; its behaviour with picric acid; tetra-nitro-dinaphthyl-methan; and dibrom-dinaphthyl-methan.

Reduction Products of the Nitro-Benzoic Acids.—P. Griess.—The author gives the name meta-oxy-benzoic acid to the compound $\text{C}_{14}\text{H}_{10}\text{N}_2\text{O}_5$, which he formerly designated as azo-oxy-benzoic acid. He examines its behaviour with tin and hydrochloric acid, and describes orthazo-benzoic acid, $\text{C}_{14}\text{H}_{10}\text{N}_2\text{O}_5$.

Constitution of the Pseudo-Nitroles.—V. Meyer and J. Locher.—An account of the action of nascent hydrogen upon propyl-pseudo-nitrol; of chromic acid upon the same body; and of dinitro-propan.

Allylic Alcohol in Crude Wood-Spirit.—B. Aronheim.—The author announces that he does not intend to continue the investigation of this subject.

Notice on Diazo-Amido Compounds.—P. Griess.—The two compounds diazo-benzol-amido-brom-benzol and diazo-brom-benzol-amido-benzol are identical.

On Nitro-Ethan.—A. Geuther.

Boiling-Point of Glycerin.—A. Oppenheim and M. Salzmänn.—The authors find the corrected boiling-point of glycerin to be 290.4° .

Reduction of certain Aromatic Ketons by Hydriodic Acid and Phosphorus.—C. Graebe.—Not suitable for abstraction.

Difference between the Boiling-Points of Diphenyl and Diphenylen Compounds.—C. Graebe.—The differences, as shown in a table, are about 40° or 41° .

On Cyanamid.—E. Mulder.—The author examines the behaviour of cyanamid with oxalic ether, and the action of the former upon alloxantin, the result of which is iso-uric acid. This body is more readily oxidised than uric acid. Urea does not react upon alloxantin, neither does dicyan-diamid. Melamin reacts, but without forming iso-uric acid. Hydurilic acid does not decompose alloxantin.

Cyanamid: Methods for Desulphurisation.—E. Mulder and J. A. Roorda Smit.—Not suitable for abstraction.

Nitroso-Benzol and Nitroso-Naphthalin.—A. Bayer.—The author has not yet succeeded in isolating the former body, nor in obtaining the latter in a state of perfect purity. To prepare the former, he introduces a solution of NOBr in benzol into a solution of hydrargyro-phenyl in benzol in equivalent proportions. The liquid turns green, depositing colourless crystals—probably hydrargyro-bromide of phenyl—and gives off an odour of oil of mustard. The filtered liquid, on distillation in steam, yields a fine green liquid of penetrating odour. The green matter, however, could not be isolated. With tin and hydrochloric acid there was a formation of aniline. On gently heating for a short time with acetate of aniline a deep orange colour appeared, and proportionately large quantities of azo-benzol were obtained. Dilute alkalis destroy the green colour, but not the odour. Concentrated hydrochloric acid decomposes the substance with an orange,

and concentrated sulphuric acid with an intense violet-red colouration. From the formation of aniline and azobenzol it is highly probable that the green body contains nitroso-benzol. The benzol employed as solvent plays no part in the reaction, since it may be replaced by chloroform or bisulphide of carbon without affecting the result. To produce nitroso-naphthalin hydrargyro-naphthyl was dissolved, with the aid of heat, in 50 parts bisulphide of carbon, and when cold treated with a mixture of bromine and bisulphide of carbon, previously saturated with NO at -20° . Nitroso-naphthalin combines with aniline at once, forming a red substance; in concentrated sulphuric acid it dissolves with a cherry colour; if heated with alkalis and acids it is decomposed; and if dissolved in phenol it yields a blue colour on the addition of sulphuric acid—all phenomena which point to a nitroso derivative.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the treatment of sewage, night-soil, and towns'-refuse, and like matters to utilise them as manure, and in the production of an artificial fuel to be employed in the said treatment, and for other purposes. William Henry Hughan, Southport, Lancaster. June 5, 1874.—No. 1959. The petitioner throws into closets, sewers, or sewage-tanks a preserving powder to prevent decomposition, which he calls the sanitary powder; then he adds a second powder, which causes the manurial products to be precipitated, which he calls the precipitating powder; he then drains off the water by downward filtration, and the residuum is mixed with hot superphosphate manufactured in the usual manner, and in about twenty-four hours becomes a dry sewage phosphate manure or night-soil phosphates. The petitioner forms the above-named sanitary powder of portland cement or like materials, sulphates of soda, magnesia, and potash, mixed in oil (mineral oil preferred) until of a consistency of mortar, and decomposed by sulphuric acid, well boiled, and when dry is ready for use. He also manufactures a powder for the same purpose from material such as kainit and seaweed boiled with clay (china preferred) and soda waste, all reduced to pulp until saponified, the mass being then treated with sulphuric acid. The precipitating powder is formed of portland cement or like material with a little fluor spar mixed, soaked, or set in oil, mineral, or the distilled oil from the carbonisation of coal-ashes hereinafter mentioned, until indurated, and then powdered. For use in dry closets the petitioner forms a powder from the carbonisation of coal-ashes in gas revolving-retorts, the gas and oil being collected. The cinders are separated, and the black ash portion is the powder for closets. The contents of the closets and powder are mixed with animal cement powder, viz., farm-yard manure (or rich street-sweepings or sea-weed) triturated in a mill with diluted sulphuric acid (or plaster of Paris), and further incorporated with clay and quartz or sea-weed until capable of being moulded into bricks, which are dried, calcined, closed from, and then burnt in the open air as cement until all the charring has disappeared: the result of the mixture is a rich nitrate manure. The fuel is formed by mixing peat, pulp, sand, and clay with hot Yorkshire or other similar lime, and slaking in closed vessels. The ashes from this fuel form a good portland cement.

Improvements in the manufacture of sulphate of potash, and in apparatus employed therefor. Charles Stuart Gorman, chemist, Irvine, Ayr, N.B. June 6, 1874.—No. 1971. The features of novelty which constitute this invention are:—First. Mixing with chloride of potassium, alkali or chrome waste, lime, and magnesia, as and for the purposes described. Second. Introducing the gases and vapours into the decomposing chamber through a pipe extending throughout the chamber before the gases and vapours are allowed to mix with the chlorides, and terminating the gas inlet-pipe in or about the centre of the top or bottom of the decomposing chamber. Third. The employment of metallic oxides unmixed with the chlorides to promote the oxidation of sulphurous acid before it is introduced into the chlorides under conversion. Fourth. The employment of chlorine to promote the oxidation of the sulphurous acid as and for the purposes described. Fifth. The employment of nitric acid to promote the oxidation of the sulphurous acid as and for the purposes described.

Improvements in the treatment of sugar and cane juice. James Duncan, sugar refiner, Mincing Lane, London. June 8, 1874.—No. 1989. The reduction of the glucose in sugar by means of lime and the precipitation of the lime by means of sulphuric acid as hereinbefore described; also the neutralisation of the free acids arising in the course of the foregoing process by means of carbonate of lime.

Improvement in the preparation of products of aniline, and matters from which aniline is or may be derived, suitable to be used in dyeing and printing, and in the preparation of colouring matters. John Casthelaz, manufacturing chemist, Crumpsall Vale Chemical Works, near Manchester, Lancaster. June 10, 1874.—No. 2009.—According to this invention aniline or nitrobenzene is treated with sulphuric acid in excess, and with bichromate of potash or other oxidising agent with or without heat. From the product a soluble colouring-matter can be extracted, which imparts a brown tint to woollen or other matters, the said brown tint changing to black when the dyed matters are treated with a bath of bichromate of potash, followed by an alkaline bath. Chromic acid, or ammoniacal solution of copper, or salt of copper, and

several other agents may be substituted for the bichromate of potash; aniline black is also obtained by heating this product, or emeraldine, or other insoluble aniline black along with an excess of aniline, and with or without chlorhydrate of aniline or other aniline salt. The product is soluble in alcohol, and may be rendered soluble in alkali or water by heating with sulphuric acid.

Improvements in the manufacture of sulphate of soda and sulphate of potash. William Hunt, manufacturing chemist, of Castleford, near Normanton, York. June 10, 1874.—No. 2016. According to this invention the chloride of sodium (common salt) or chloride of potassium, before it is decomposed in the chambers by a mixture of sulphurous acid gas, steam, and air, is made or moulded into layers or blocks, and perforated with a series of holes at short distances apart. By means of these perforations the direct entrance of the gaseous mixture into the interior of the layer or block is secured, greater surface for the gaseous mixture to act upon is produced, and the draught of the gaseous mixture through the chambers is less impeded than when the lumps operated upon are solid. The decomposition of the salt is effected in less than one-half the time required in the ordinary process, and finely ground rock-salt may be advantageously employed.

Improvements in the manufacture of sulphates, and in apparatus employed therein. James Hargreaves, chemist, and Thomas Robinson, ironfounder, both of Widnes, Lancaster. June 10, 1874.—No. 2018. This relates to further improvements in and in connection with the patentees' direct action process of producing sulphates of soda and potassa, or either of them. First. For preventing loss of heat by radiation from the sulphurous acid flues, the arch or covering connection between the chambers is lowered, and the connecting pipe between the sulphurous acid flues is laid in the solid brickwork, and the heated gases conveyed through the said connecting pipe. By preference the said connecting pipe is laid below the circulating pipe at one end of the sulphate chambers. Second. For keeping cool the bearings of rotary exhausting apparatus employed in the manufacture of sulphates we form the bearing brackets hollow at a distance from the sides, and cause a current of water to flow through the said hollow bearings. We also use oil or other lubricant over and over by pumping or raising it, and allowing it flow over the bearings. Third. Instead of using a syphon to take the products of combustion into the chambers when heating chloride with the products of combustion, we employ a cover for the feed-hole of such form that an annular passage is left around the feed-hole, and we cause the products of combustion to flow through the said annular space and through the feed-hole. By reversing the current of gas we cause the remaining sulphurous acid and steam to pass through the said feed-hole and annular opening previous to discharging a chamber. Fourth. For preventing gases from passing through the walls of brick chambers we build into the said walls plates of iron or other metal.

Improvements in the treatment of animal charcoal used in the decolorisation of sugar solutions. Charles James Crossfield, and James Barrow, sugar refiners, and Edmund Alleyne Cook, analytical chemist, all of Liverpool, Lancaster. June 10, 1874.—No. 2024. This consists essentially in so treating spent or used charcoal as to produce pyrophosphate therein.

Improvements in the manufacture of soft white soap. Gerard Joan Jacobson, Opollo Stearine Works, Schiedam, Holland. June 10, 1874.—No. 2030. A very useful household soap is made of oleine (oleique acid) mixed with soda or kalie lye and hot water in the quantities specified as follows:—2 gallons of distilled oleine, 1 gallon of lye, 5 gallons of hot water. While pouring the hot water into the oleine the mass should be constantly stirred, and at the same time the lye must be slowly dropped in; stirring must be continued until the whole mass has assumed the appearance of a thick yellowish soap without curdles. After twenty-four hours' rest the soap is perfectly white and ready for use.

Improvements in preserving fresh uncooked meat and other animal food, and antiseptic mixtures for that purpose. Alexander Herzen, doctor of medicine, Florence, Italy. June 11, 1874.—No. 2032. This invention relates to the preservation of fresh uncooked meat and other animal food in its natural condition, without change of colour or flavour, by immersing it for a time in a solution of a mixture of boracic acid, borax, salt, and saltpetre, and then packing it, preferably in fat of the same kind.

MEETINGS FOR THE WEEK.

- MONDAY, 5th.—Medical, :
— London Institution, 5.
— Royal Institution, 2. General Monthly Meeting.
- TUESDAY 6th.—Civil Engineers, 8.
— Zoological, 8.30.
— Royal Institution, 3. Prof. Duncan, "On the Grandeur Phenomena of Physical Geography."
- WEDNESDAY, 7th.—Society of Arts, 8.
— Pharmaceutical, 8.
— Microscopical, 8.
- THURSDAY, 8th.—Royal Institution, 3. Prof. Seeley, "On the Fossil Forms of Flying Animals."
— Royal, 8.30.
- FRIDAY, 9th.—Royal Astronomical, 8.
— Quekett Club, 8.
— Anthropological, 7.30.
— Royal Institution, 8. Weekly Evening Meeting.
9, Sir William Thomson, "On Tides."
- SATURDAY 10th.—Royal Institution, 3. Mr. G. Smith, "On the History of Assyria."
— Physical, 3. Prof. H. M'Leod, "On an Experiment Illustrating the Want of Achromatism of the Eye."
J. Barrett, "On a Form of Mercurial Air-Pump."

THE CHEMICAL NEWS.

VOL. XXXI. No. 802.

SHORT NOTICES OF SOME CORNISH MINERALS.

By Professor A. H. CHURCH, M.A., &c.

1. *Steatite*.—A year or more ago I obtained from Mr. Richard Talling, of Lostwithiel, some small specimens of a very pretty pink variety of soapstone. It presented a considerable resemblance to certain pink figure stones from China, but exhibited a rather more saliny lustre in places, while in other spots it was more sub-translucent. Its hardness was above 1 on the surfaces of the plates and fibres of which the mineral consisted, while in a direction at right angles to these fibres the hardness exceeded 2. The specific gravity was 2.70. The mineral, on analysis, proved to be a hydrated magnesium silicate, with mere traces of alumina, iron, and manganese. It contained less than 1 per cent of hygroscopic water; removed either over sulphuric acid *in vacuo*, or at 100° C. The dry mineral gave the following percentage:—

Magnesia	..	..	..	..	32.89
Silica	..	..	..	..	63.18
Water	..	..	..	..	4.47
					100.54

These numbers point very clearly, I think, to a simple and satisfactory expression for this mineral. The formula, $3\text{MgO}, \text{H}_2\text{O}, 4\text{SiO}_2$, requires these percentages:—

3MgO	=	120	=	31.75
4SiO_2	=	240	=	63.49
H_2O	=	18	=	4.76
		378		100.00

It is a silicate of magnesia, in which one-fourth of the magnesia is replaced by water. Analyses 10, and 12 to 22 in Dana's "Mineralogy," p. 453, referring to similar minerals from different localities, also agree well with the above formula. In other analyses, likewise referred to talc by Dana, the divergences can often be explained on the supposition of the presence of about 1 per cent of hygroscopic moisture, and the replacement of some of the magnesia by ferrous oxide. Some experiments now in progress on saponite, pagodite, and agalmatolite will, I hope, clear up some remaining difficulties connected with the so-called soapstones.

2. Not many months ago I received from Mr. Talling a nearly white crystalline mineral, which I have been unable to identify with any known species. It occurs in short, silky crystals, implanted on a translucent pale green vitreous substance, not unlike allophane. The crystals there have a slight greenish hue resembling that of ferrous sulphate. The quantity received as yet has been sufficient merely for a qualitative examination. The mineral contains much water, some fluorine, and a good deal of silica, and of ferrous oxide. It loses 15.14 per cent of its weight at 100° C., and 20.24 per cent at a red-heat; the total loss thus amounting to no less than 35.38 per cent.

3. *Native Gold* from Cornwall. Some grains of gold from Ladock gave, on analysis,—

Gold	..	..	..	92.34 per cent.
Silver	..	..	..	6.06 "
Iron	..	..	..	trace
Silica and loss	..	..	..	1.60 "

100.00

4. *Native Silver*.—A beautiful old specimen of native silver from Huel Herland recently came into my posses-

sion. It was filiform, and of specific gravity 10.38. On analysis I obtained—

Silver	..	..	..	99.05 per cent.
Iron	..	..	..	0.59 "
Loss, &c.	..	..	..	0.36 "

100.00

The iron found might, in part at least, be due to a trace of iron pyrites, which also occurred in the matrix of the specimen. Neither gold nor copper were present.

ON SOME PROPERTIES OF NITRO-GLYCERIN [$\text{C}_3\text{H}_5(\text{NO}_2)_3\text{O}_3$].

By SERGIUS KERN, St. Petersburg.

STUDYING now the properties of some explosive substances, I think this preliminary notice on nitro-glycerin will be of some interest. The nitro-glycerin for the experiments was prepared in the ordinary way, only the apparatus was slightly altered. The glycerin ($\text{C}_3\text{H}_8\text{O}_3$) was poured into a funnel, 5 grms. capacity, with a long glass tube and a tap near the neck of the funnel. The mixture of equal quantities of fuming nitric and sulphuric acids was poured into a high glass surrounded with another filled with water. The glass tube of the funnel was next introduced into the acid mixture, and the tap was opened. Then, as the glycerin flowed into the mixture, it was quickly stirred together by the same funnel-tube. The operation finished, all the liquor was poured into a deep glass vessel filled with water; the nitro-glycerin sunk was collected and dried over sulphuric acid under a glass bell-jar. The nitro-glycerin obtained was nearly colourless with a light yellow tint. The sp. gr. was found to be 1.6 at 15°; it solidified only at -4° in a crystalline mass.

At the following temperatures nitro-glycerin underwent the following modifications:—

- 187°—ebullition; separation of orange vapours.
- 220°—strong explosion.
- 262°—the most strong explosion.
- 294°—very feeble explosion, accompanied with a yellowish flame.

It is seen from this small table that the explosive properties of nitro-glycerin nearly disappeared at a high temperature.

LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE

CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

(Continued from page 121).

LECTURE XII.

THE symmetrical system next passing under review was that in which two original planes of symmetry intersect at an angle of 60°. Two such planes will result in a third plane of symmetry inclined on each of them at 60°; and if we first consider the repetitions that, for instance, a pole lying independently on the sphere (that is to say, not engaged with a circle of symmetry) would undergo as the result of the form to which the pole belongs, being symmetrical to these three planes and to a centre, we shall see that it will result in twelve poles, the faces of which would be parallel in pairs and grouped as in Fig. 11, with the form $\{kkl\}$ where the spots represent the poles as distributed on one hemisphere, and the eyelets those opposite to them on the opposite hemisphere of projection.

It is, however, to be observed that the zone plane perpendicular to the three plane of symmetry itself fulfils the

$$\begin{aligned} e &= 2(k+l) - h. \\ f &= 2(l+h) - k. \\ g &= 2(h+k) - l. \end{aligned}$$

The various kinds of tetartohedral forms were next discussed, the kind represented by the symbol $\alpha\pi\{h\ k\ l\}$

FIG. 12.



and $\alpha\pi\{khl\}$ being represented on quartz, the one by crystals presenting dextro-gyral, the other by crystals presenting lævo-gyral, action on a plane polarised ray of light; and, finally, the unique case in crystallography of a tetarto-systematic form was illustrated by the crystals of diopside and phænakite presenting the forms $\phi\pi\{hkl\}$.

(Concluded from page 146.)

White 60 per cent.	White 70 per cent.	Cream 60 per cent
NaHo .. 70'00	82'00	70'00
Na ₂ CO ₃ .. 6'00	5'00	5'00
NaCl 18'50	7'00	7'00
Na ₂ SO ₄ .. 5'50	6'00	2'00
Water .. —	—	15'80
Insol. in water —	—	0'20
<hr/>	<hr/>	<hr/>
100'00	100'00	100'00

* A Paper read before the Newcastle-upon-Tyne Chemical Society.

I have remarked that if on packing a batch of caustic soda the slightest turbidity appear, the finished product will on cooling be very inferior. If a drum of such caustic be broken up, the section will probably show a white ring or corona, where the mass has first cooled, but which gradually changes to a dirty grey towards the central or last solidified portion. And it might be fairly imagined by any one inspecting a drum of this unsatisfactory character, that samples taken from the bad core would produce either a tinted solution, or would contain a pretty fair amount of insoluble matter. Such, however, is not usually the case, for even the most hopelessly bad pieces generally give, together with a perfectly colourless solution, the veriest trace of a beautiful white sediment consisting of lime. Occasionally, however, a little iron is present, but the two combined rarely exceed $\frac{1}{10}$ to $\frac{1}{100}$ of a per cent. Sometimes also alumina separates on neutralising the clear liquor with an acid, showing aluminate of soda to have been present. This latter is not a little singular, for the bottoms invariably contain alumina, and why the caustic soda should at an odd time take up a portion seems rather curious. Sometimes in inferior looking samples of caustic soda the aluminate is present without any other impurity exhibiting itself, which would go to prove the insolubility of aluminate soda in the concentrated hydrate.

The caustic drums should never be packed straight ahead till completely full, but by three or four instalments. In the former case, as it cools, it contracts or withdraws from the centre, leaving a hollow core right through the axis of the drum, and causes a loss in drums of nearly 10 per cent, equal to 1s. 6d. to 2s. per ton of caustic soda.

In the manufacture of caustic soda, the water employed is an item of considerable importance, for in the production of every ton of 70 per cent, no less than 14½ tons water must be converted into steam; and it is rather strange that, with one or two solitary exceptions, not the slightest attempt is made to utilise the enormous waste and loss of heat. I feel quite satisfied that by judiciously fixing a hood over the boat-pans or caustic pots, communicating with some simple description of surface condenser, not only could a considerable amount of water be saved, but the expenditure of steam for causticising, &c., might be also materially lessened. But it requires a little courage on the part of managers to move out of the beaten track, for in Lancashire especially there is little sympathy with failures.

The production of salt cake (including "bottoms," if sold) is, in well-conducted works, 54 to 57 per cent of 60 per cent caustic soda, and the proportion of "bottoms" is 9 to 11 per cent of the good caustic. If, however, much "red" liquor from the soda ash department be used, this proportion will be larger, or say 12 to 14 per cent.

The amount of salt necessary for reduction to 60 is 15 to 16 per cent of the caustic soda packed, though it varies considerably; and the amount of nitre is 1½ to 2 per cent. Reckoning, however, ½ to be recovered in the form of caustic alkali, the real loss only amounts to $\frac{3}{4}$ to 1 per cent. The total quantity of fuel for all purposes should not exceed 6 to 6½ tons, but in many works the consumption is over 7 tons per ton of caustic soda. It may be divided as follows:—

		Tons. Cwts. Qrs.		
B. A. Furnaces	Mixing	1	0	0
	Firing	2	0	0
	Boat-pans ..	2	0	0
	Caustic pots ..	1	0	0
	Boilers	0	10	0
Total		6	10	0

The raw materials and total expenses per ton of 60 per cent may be put down as follows:—

		£	s.	d.
Fuel, say 6½ tons, at 7s. 6d.		2	5	6
Salt cake, 37 cwts. ,, 3s. 3d.		6	0	3
Limestone, 22 ,, ,, os. 4d.		0	7	4

		£	s.	d.
Lime, 11 cwts. at 1s. 6d.		0	11	0
Salt, 3 ,, ,, os. 8d.		0	2	0
Nitre, 40 lbs. ,, os. 1½d.		0	5	0
Wages		2	0	0
Water		0	1	6
Drums		0	16	0
Charges and shipment		0	15	0
Office expenses and management		0	5	0
Interest on capital, depreciation, stores, &c. ..		0	16	0

Total cost *f.o.b.* Liverpool £14 4 7

I have but briefly entered into the manufacturing details of cream caustic soda, my desire being principally to describe minutely those of white. The colour is due to the presence of peroxide of iron, which is held in solution or suspension by the soda at its comparatively low finishing temperature, but which separates on solution of the caustic in water. Tate suggests the presence of ferrate of sodium, which would be decomposed on treatment with water.

If the cream caustic be prepared from uncausticised "red" liquors, a considerable quantity of nitre is necessary, namely, about 1 cwt. per ton of soda produced. In the latter case, also, much less fuel is required, as in place of being evaporated down from about 15° T. the concentration of the liquors only commences at about 60°, that being their average strength.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Anniversary Meeting, Tuesday, March 30th, 1875.

Professor ODLING, F.R.S., President, in the Chair.

THE President, Dr. ODLING, in his annual address, congratulated the Fellows on the satisfactory state of the Society; the number of Fellows was now 801, 84 having joined the Society during the past year, whilst, by removals, resignations, and deaths, they had lost 16. The names of the Fellows deceased were Thomas Anderson, M.D., T. W. Burr, H. Dircks, D. Hanbury, F.R.S., F. C. Matthews, Henry Matthews, Henry Medlock, Ph.D., Mr. J. Starks, and Col. P. Yorke, F.R.S. The communications made to the Society during the past year were 65 in number, the largest ever sent in in any year since the foundation of the Society. The President then alluded to the very successful Faraday lecture recently delivered by Dr. Hofmann, and, on behalf of the Society, tendered his thanks to Professor Nevil Story Maskelyne, for the course of lectures on Crystallography which he had given.

In evidence of the greatly increased activity of the Society, he might say that the average number of Fellows in the three years ending March, 1872, was 586, and the number of communications 30 per annum; whilst in the three years ending March, 1875, the number of Fellows was 739, and the number of communications had increased to 59. The development of chemical industry in its application to the manufacture of so-called organic products had been very striking during the last twenty years, and thus the practical fruit of the pursuit of abstract chemical science had again largely contributed to the progress of abstract investigation, since many of the compounds, manufactured on a large scale, are amongst the most valuable raw materials of the scientific chemist.

The analytical methods for the detection of food adulteration which, with few exceptions, had long been in a most unsatisfactory condition, are now being replaced by others more trustworthy and more accurate. With regard to the general policy of adulteration acts, however, it should not be forgotten that legislative interference with manufactures of any kind was far from conducive to manufacturing progress.

The TREASURER then read his report, from which it appeared that the removal to the new rooms involved a large increase in the ordinary annual expenditure, and although, at present, the ordinary expenses somewhat exceeded the income, this will soon cease to be the case, from the increase in the number of Fellows.

The election of Officers and Council was then proceeded with, Mr. J. Williams and Mr. E. C. Nicholson being appointed Scrutators. The following is a list of the officers elected for the ensuing year:—

President—F. A. Abel, F.R.S.

Vice-Presidents who have filled the office of President—

Sir B. C. Brodie, F.R.S.; Warren De la Rue, D.C.L., F.R.S.; E. Frankland, D.C.L., F.R.S.; A. W. Hofmann, D.C.L., F.R.S.; W. Odling, M.B., F.R.S.; Lyon Playfair, Ph.D., C.B., F.R.S.; A. W. Williamson, Ph.D., F.R.S.

Vice-Presidents—J. H. Gilbert, Ph.D., F.R.S.; J. H. Gladstone, Ph.D., F.R.S.; A. Vernon Harcourt, M.A., F.R.S.; G. D. Longstaff, M.D.; J. Stenhouse, Ph.D., F.R.S.; A. Voelcker, Ph.D., F.R.S.

Secretaries—W. H. Perkin, F.R.S.; H. E. Armstrong, Ph.D.

Foreign Secretary—H. Müller, Ph.D., F.R.S.

Treasurer—W. J. Russell, Ph.D., F.R.S.

Other Members of Council—J. Attfield, Ph.D.; Dugald Campbell; J. Dewar, F.R.S.E.; M. Foster, M.D., F.R.S.; David Howard; Nevil Story Maskelyne, F.R.S.; E. J. Mills, D.Sc.; J. A. Phillips; Hermann Sprengel, Ph.D.; R. V. Tuson; R. Warrington; C. R. A. Wright, D.Sc.

Dr. SIEMENS then proposed a vote of thanks to Professor Odling, the retiring President, which was seconded by Mr. J. TENNANT, and carried by acclamation.

Dr. ODLING having made a suitable reply,

Mr. A. SMEE proposed, and Mr. J. NEWLANDS seconded, a vote of thanks to the Officers and Council, which was responded to on their behalf by the Senior Secretary, Mr. W. H. PERKIN.

After the usual vote of thanks to the Auditors, proposed by Professor ABEL, and seconded by Mr. J. SPILLER, the meeting was adjourned until Thursday, April 1st.

Thursday, April 1, 1875.

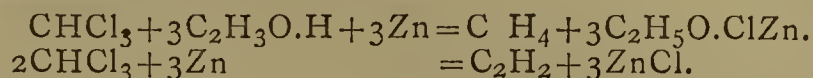
Professor ABEL, F.R.S., President, in the Chair.

The minutes of the preceding meeting having been read and the visitors announced, the following names were read for the first time:—J. E. Stoddart, W. M. Hamlet, H. M. Hastings, H. S. Carpenter, A. Southall, and W. A. Little. For the third time, Messrs. Arthur Taylor, M. G. Crossman, Charles A. Heywood, Samuel A. Hill, Edward Lawrence Cleaver, R. Elliott Cunningham, Cornelius O'Keeffe, Matthew W. Williams, James Wilson, and George E. Davis. Messrs. Thomas Howard and J. Ackworth were formally admitted Fellows of the Society.

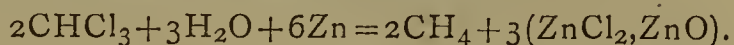
The newly elected PRESIDENT said, that before proceeding to the usual business of the meeting, he wished to express the profound gratitude he felt for the honour the Society had conferred on him by electing him as their President. He would endeavour, to his utmost, to uphold the character of the Society; but the distinguished chemists who had preceded him in that office, and especially the one he had immediately succeeded, whose grasp of the philosophic bearings of any subject, and aptitude in detecting points for discussion, had formed one of the great attractions of their meetings, rendered this especially difficult. They might rest assured, however, that the interests of the Society would be zealously watched and warmly cherished, as long as he held the office of President.

The first paper, "*Researches on the Action of the Copper-Zinc Couple on Organic Bodies (Part VIII., On Chloroform, Bromoform, and Iodoform)*," by Dr. J. H. GLADSTONE and Mr. A. TRIBE, was read by the latter. The

dry couple has no action on chloroform, but when heated with it in the presence of absolute alcohol, gas is rapidly evolved, which, on examination, proved to be marsh gas, mixed with a small amount of acetylene. Chlorethylate of zinc is left in the flask, so that the reaction may be represented by the equations—



With water the action is somewhat similar, marsh gas and zinc oxychloride being produced—



With bromoform and absolute alcohol the result takes place after a few minutes with almost explosive violence, so that it is necessary to immerse the flask in cold water. The results are similar to those obtained with chloroform, but the proportion of acetylene produced is much larger.

When zinc foil is substituted for the couple the reaction is nearly the same, but the amount of marsh is larger.

Iodoform gives results very similar to those obtained with bromoform, but the reaction is not nearly so violent.

Mr. W. H. PERKIN said it was remarkable that no intermediate chlorinated compounds were produced in this reaction, as was the case when chloroform was treated with zinc powder, especially since their volatility would at once remove them from the further action of the couple.

In reply to a question of Professor TILDEN,—

Mr. J. WILLIAMS said the best method of preparing bromoform was by the action of alkalies on bromal.

The PRESIDENT, having thanked the authors in the name of the Society,—

Dr. W. A. TILDEN read a paper "*On the Action of Nitrosyl Chloride on Organic Bodies (Part II., On Turpentine Oil)*." When nitrosyl chloride, evolved from the sulphate and common salt, is poured into oil of turpentine, it becomes hot, and much brown resinous matter is produced; but if the liquid be kept cool by a freezing mixture, a white odourless powder is produced, which is nearly insoluble in cold alcohol, and cannot be re-crystallised without undergoing decomposition. It has the composition $\text{C}_{10}\text{H}_{16}\text{NOCl}$, and when treated with an alcoholic solution of soda, loses the elements of hydrochloric acid, and yields *nitrosoterpene*, $\text{C}_{10}\text{H}_{15}\text{NO}$, a beautiful colourless crystalline compound. It melts at about 130° , dissolves readily in a hot solution of soda, and crystallises from it unchanged. It is not reduced by alcoholic sulphide of ammonium, but with sodium amalgam it gives free ammonia and a hydrocarbon. It unites with bromine to form a crystalline addition product, $\text{C}_{10}\text{H}_{15}\text{NOBr}_2$, and when heated to 180° with turpentine or benzene, it yields a waxy granular substance, having the same composition as the original body, with which it is probably polymeric.

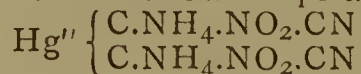
The PRESIDENT said they were much indebted to the author for his very interesting communication, and he should be glad to hear any remarks that members might have to make on the subject.

Dr. HOFMANN was glad that the importance of the reduction of this body had not escaped the notice of Dr. Tilden. He had found that substances which resisted the ordinary method of treatment with an alcoholic solution of sulphide of ammonium yielded at once to that reducing agent, when heated with it for a few hours in a sealed tube.

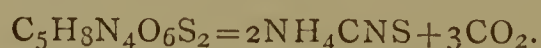
Professor TILDEN, in reply to a question put by Dr. ARMSTRONG, said he had not studied the action of oxidising agents on the compound, as, from its great alterability, he did not expect satisfactory results.

Dr. HOFMANN said he had recently occupied a considerable time in reading the papers of Liebig, and had derived great advantage from their study. He could recommend their perusal to chemists for the value of the suggestions thrown out and the number of experiments alluded to, which were well worth taking up. Amongst these were his early papers on the fulminates. Liebig

was struck with the identity in composition between fulminate and cyanate of silver, and had a great desire to find some cyanogen product amongst the products of decomposition, and in many places states his conviction that urea would be found. Dr. Steiner, who has recently worked on this subject in the Berlin laboratory, finds that urea is one of the most frequent products of the decomposition of the fulminates. Aniline was first tried; this acts violently on the fulminates, yielding two substances, one of which is monophenyl urea and the other diphenylguanidine; with toluidine similar substances are produced. The action of ammonia itself was then examined, and it was found that when the fulminate is heated with it, it at once yields urea and guanidine. These, however, are only the ultimate products; for if mercury fulminate be digested with ammonia at a low temperature, a compound



is formed, and this, when heated, gives besides urea and guanidine, various substances, which crystallise with the greatest facility, amongst which he might mention two bodies having the composition $\text{C}_7\text{H}_{13}\text{N}_{11}\text{O}_3$ and $\text{C}_6\text{H}_{11}\text{N}_9\text{O}_3$. Again, Dr. Gladstone, many years ago in Liebig's laboratory, tried the action of sulphuretted hydrogen on silver fulminate, and obtained ammonium sulphocyanate. These experiments were afterward repeated by Kekulé, who found, however, that only a portion of the carbon went to form the sulphocyanate, another portion being given off as carbonic acid. Dr. Steiner has recently passed sulphuretted hydrogen through mercury fulminate, suspended in anhydrous ether; mercury sulphide is formed, and the ethereal solution, when allowed to evaporate spontaneously, leaves a residue consisting of ammonium sulphocyanate and a magnificent white crystalline substance, $\text{C}_5\text{H}_8\text{N}_4\text{O}_6\text{S}_2$, which is insoluble in water, and is left behind when the product is treated with water. This new compound only exists at temperatures below 24° , above that temperature it splits up with violent ebullition, thus:—



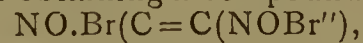
It is perhaps formed from fulminic acid, thus:—



The other communication he had to make was a simple experimental illustration, to show that when chlorine displaces oxygen, only one volume of the latter is liberated for every two of the former absorbed. It was well known that when a solution of chloride of lime was heated with a little sesquioxide of cobalt, or nickel oxygen was evolved, so that if chlorine were passed into a boiling solution of caustic soda containing some of the sesquioxide suspended in it, it would be absorbed, and oxygen given off. A long tube, about a metre in length, sealed at one end and closed at the other with a stopcock is filled with chlorine, and then about 20 or 30 cubic centimetres of soda solution, containing suspended in it some freshly precipitated sesquioxide of nickel, is allowed to run in. If the tube be now heated in a water-bath, and, when cold, the stopcock is opened under water, it will rush in until the tube is half full. The two volumes of chlorine have disappeared, and the one volume of gas now in the tube will be found to be pure oxygen.

Dr. ARMSTRONG said that for some months past he had been working on the fulminates, and he believed that Kekulé's formula, $\text{C.NO}_2.\text{CN.H}_2$, which made fulminic acid the nitro-derivative of cyanomethane, was not so well founded as was generally supposed. Meyer, by the action of nitrous acid OH.NO on secondary nitropropane, $\text{C}(\text{CH}_3)_2\text{H.NO}_2$, obtained a body $\text{C}(\text{CH}_3)_2\text{NO.NO}_2$, but the action was different with primary nitropropanes; the ethyl compounds, for example, yielded $\text{C}(\text{CH}_3)(\text{NOH})\text{NO}_2$. It seemed probable that fulminic acid was not a nitro-derivative, but perhaps a compound $\text{NO.HC}=\text{C}(\text{NOH})''$. The results obtained in Dr. Hofmann's laboratory might perhaps be explained on this hypothesis, but they would no doubt lead to the elucidation of this matter. He him-

self intended to study the action of bromine on the fulminates, in hopes of obtaining a compound—



but this would most probably be unstable, and be at once changed into $\text{NO.BrC}=\text{CBr.NO}$.

Dr. HOFMANN said, it should be remembered that Kekulé had not only proved that chloropicrin is produced by the action of chlorine on the fulminates, but also that chloride of cyanogen is formed; if, however, they went on investigating the matter at Berlin, and Dr. Armstrong did so here, they would doubtless arrive at some definite notion of the constitution of the fulminates.

The meeting was then adjourned until Thursday, April 15th, for which the following papers are announced:—(1) "On the Gases Enclosed in Coals from the South Wales Basin," by J. W. Thomas; (2) "On Narcotine, Cotarnine, and Hydrocotarnine," by G. H. Beckett and Dr. C. R. A. Wright; (3) "Note on Isomeric Change in the Phenol Series," by Dr. H. G. Armstrong; (4) "On Andrews site and Chalkosiderite," by Professor Nevil Story Maskelyne; (5) "An Examination of Methods for Effecting the Quantitative Separation of Iron Sesquioxide, Alumina, and Phosphoric Acid," by Dr. W. Flight.

SOCIETY OF PUBLIC ANALYSTS.

THE following cases of successful prosecution for the adulteration of milk will be found to be of interest to many Public Analysts, involving as they do several points upon which much difference of opinion exists, such as whether abstracting the cream from milk can properly be regarded as an adulteration, and whether the personal attendance of the Analyst, in the absence of any scientific evidence on behalf of the defendant, should be required to confirm his certificate.

It will be seen from these cases that neither in Wales nor in Ireland has the Act of 1872 been allowed to become a dead letter; and it will also be noticed, from the amount of the penalties inflicted, that the magistrates appear to be of a less tender-hearted type, in their feeling towards offenders, than many of the Metropolitan ones.

MILK PROSECUTIONS.

At the Swansea Police Court, a milk dealer was summoned for unlawfully selling, as pure or unadulterated, certain milk which was then and there found to be adulterated, or not pure. Mr. Smith appeared for the defendant. The inspector deposed that on the morning of the 11th day of March he met the defendant, and asked him if he sold milk; he replied "Yes," and he then purchased a pint of him, for which he paid $2\frac{1}{2}$ d. He put two-thirds into a bottle which he sealed, and the remaining one-third he put into another bottle, which he sealed and gave to the defendant. He then told him he was going to have the milk analysed, and that he could accompany him to Dr. Morgan with the sample if he chose. He, however, did not do so. Dr. Morgan, the Public Analyst, was then sworn, and handed in his certificate of the result of his analytical test. The sample contained 80 per cent of genuine milk, and 20 per cent of skimmed milk.

Mr. Smith made a powerful defence to the Bench on behalf of the defendant. He said that all the constable bought was milk and nothing but milk, and they were not charged with selling anything but milk. A great deal had been said about adulteration, and he could not for one moment wish to uphold adulteration; but at the same time he must do his duty to his client, and he contended that adulteration could not be by simply taking away one of the component parts. You could not adulterate water by subtracting from it, and so in like manner he contended that they could not adulterate milk by taking away. They could make it less valuable and less pure, but they could not in the strict sense say they adulterated an article by taking away from. According to the best lexicographers]

it meant to debase, to lessen in value, to corrupt, not by abstracting from, but in every sense in which these words were used, by the addition of some foreign matter. He contended that they could not corrupt by taking away. In order to ascertain the correct meaning of the word adulterate, he had referred to what was the meaning of the word debase, and he found that it meant to make impure by the admixture of a baser material; he was also bound to say that the word debase meant to reduce in fineness—purity, quality, or value—but he contended that there were no such words as these made use of in the Act of Parliament. He was quite aware that his client was charged with selling milk which was “not pure,” and he contended, first of all, that they had not adulterated in any way, because they had not by admixture put anything to, or altered the character of, the article which they had sold. Secondly, he contended that they had sold what they pretended to sell, viz., milk, and milk only; and there was nothing in the Act of Parliament in reference to the sale of milk, to declare whether they should sell new milk or old milk, or partially so. If a person asked for new milk, then (but he would not say then absolutely) he would be entitled to have the pure article; but he contended, under the circumstances stated, that they could not convict, unless it was proved that the article was adulterated by the admixture of some foreign substance—the Act clearly implied the adding to, or putting into, and not taking away from.

After a little further legal contention, the Bench decided to hear the other cases before giving their decision.

Several other persons were then charged with a similar offence, viz., selling milk which was not pure, *i.e.*, having been deprived to a certain extent of its fatty matter, or cream, by skimming. In one case, the sample analysed by Dr. Morgan was found to contain 64 parts of genuine milk and 36 parts skimmed milk.

The cases having been proved by the sworn certificate of the Analyst, the Bench retired for consultation, and after a short absence, the stipendiary said that two of these cases had been disposed of by giving the doubts which had arisen in favour of the defendants. The others were seven in number; and after hearing the arguments which had been directed to the Bench by Mr. Smith on the statute and the facts, and after considering the evidence as fully as they could, they had come to the conclusion to convict the defendants in the words of the statute. The allegations in the summons was to the effect that the defendants did sell a certain article, to wit, milk, which was not pure. For that offence the Bench would convict them, following the words of the statute. No doubt there was a great deal of force in the argument addressed to them on the meaning of the word adulteration. The Bench were of opinion that, if the whole expressions of the statute were taken together which had reference to “adulteration,” or “not pure,” they would cover the offence with which the defendants were charged. The scientific evidence must be taken as conclusive, unless it was upset upon cross-examination, which had not been done. In the first case (this being a second conviction), he would be fined £10 and costs; and each of the others would be fined £5 and costs. He would also say that, in the case where a fine of £10 was imposed, the Act ordered that an advertisement should be inserted in the local papers notifying the conviction, and that would be done in the usual form. These were the first cases of this exact nature which had come before the Bench, but if any more of a similar character came before them, a much higher penalty would be inflicted. It was a most serious offence to withdraw (either by adding to or subtracting from—both were equally fraudulent) the essential property of the article sold. It was most important that the public should be protected. Parents gave their children milk, which, if pure, was the most healthy and nutritious food which could be given them; but if there were subtracted from it its fatty properties, the child could not get such nourishment as it should, and the milk was obliged to be supplemented by the addition of other food. The Bench were determined to pro-

tect the public in this respect, and to see that they really obtained that for which they paid.

At the Antrim Petty Sessions, a milk dealer was summoned at the instance of the Guardians of the Poor of the Antrim Union for that he, on the 2nd day of March last past, at Antrim, in the County of Antrim, did sell as pure and unadulterated to the said complainants a quantity of drink—to wit, new milk, whereas same was adulterated, and not pure, contrary to the statute in that case made and provided, whereby defendant had for said offence forfeited and become liable to pay a penalty not exceeding £20, together with such costs attending proceedings and conviction as to the justices trying the same may seem reasonable.

Mr. A. O'Rorke appeared to prosecute on the part of the guardians, and Mr. Williamson appeared for the defendant.

Mr. O'Rorke stated the case, and having read the summons, said that the prosecution was of a very serious nature—serious so far as it affected the health of the poor people who were supplied with the milk contracted for by the defendant. Under the Poor-Law Code the guardians of the poor had to advertise for tenders for the supply for the different articles used in the different unions, and among these was the contract for new milk. Accordingly on the 9th April, 1874, the Guardians of the Antrim Union issued the following notice or advertisement:—“The Board of Guardians of this Union will, on Thursday, the 30th day of April inst., receive and consider tenders for the supply of new milk (supplemental quantity)—unadulterated—at—per imperial gallon, for twelve months, ending 30th April, 1875. Probable requirements, say from 30 to 40 gallons weekly in summer, and from 60 to 80 gallons weekly in winter. All supplies must, under a penalty, indicate eight degrees of cream on the lactometer, and show a specific gravity of not less than 1.030.” In pursuance of that advertisement, a tender was sent in by the present defendant, which tender was accepted, and the requisite sureties entered into for the supply of new milk from the 1st May, 1874, till the 30th April, 1875. The first Act he (Mr. O'Rorke) thought necessary to call the attention of the court to, was the 23rd and 24th Vic., chap. 84, with regard to the adulteration of food and drink. Having read the provisions under which, for adulteration, a defendant was liable to a penalty of £10, he said that the Legislature had passed more stringent measures in the Act of 35 and 36 Vic., chap. 74, which was passed in 1872. Mr. O'Rorke read the sections of this Act, and said that for adulteration the Legislature had been going on providing penalties ranging from 40s. to £10, and under the Act of 1872, the magistrates had power to impose a penalty of £20. Mr. O'Rorke read and commented on the different sections of the Acts of Parliament. The Legislature, he contended, had provided these Acts to meet such a case as the one with which this defendant stood charged. Moreover, the price paid was a very fair one, viz., 1s. per gallon. However, shortly after the contract was entered into, the milk was found not to be of the stipulated quality, and a letter was written to the defendant pointing this out. Notwithstanding their remonstrance, the milk supplied by the defendant continued to be less than the standard contracted for, and on the 15th January the following letter was written:—

Union Office, Antrim, 15th January, 1875.

SIR,—I am instructed by the Board of Guardians to call your attention to the fact, that the new milk supplied by you of late for the use of the workhouse inmates has been ascertained—not only by instrumental tests applied, but by personal examination by the guardians themselves—to be very inferior in quality, as compared with the milk produced by the workhouse cows, and also defective as regards the standard rate of cream and specific gravity prescribed in your bond. Under these circumstances, the guardians feel it their duty to mark their sense of this

default by imposing the penalties set forth in respect of same in the bond from the date of last settlement—viz., 26th December, 1874. The next payment will accordingly be minus the amount of reduction in price, as per ratio prescribed. I am likewise to add that the Board of Guardians will not hesitate to take still more serious notice of any continued default in the quality of milk supplied to the workhouse.

(By order),

H. C. SCOTT, Clerk of Union.

Standard rate of cream, 8 degs.—Supplies 5½ degs.
Specific gravity, .. 1.032 degs.—Do. 1.022 degs.

Mr. O'Rorke said that the guardians, finding that the amount of cream did not come up to the required standard in accordance with the bond that had been entered into from time to time, deducted from the amount of the account due to the defendant. In one account of £17 5s. they had deducted £4 6s. 3d., and an account of £20 12s. 6d. they had reduced to £14 11s. 6d. For these reductions the defendant gave a receipt, and offered no objection. The milk continuing to be below the terms of the contract, the guardians determined on sending a sample of it to Dr. Hodges for analysis. Mr. O'Rorke said, that according to the 4th section of the Act of the 23rd and 24th Vic., the productions of Dr. Hodges's certificate was made evidence. He would now read Dr. Hodges's certificate.

Mr. Williamson, who appeared for the defendant, objected to the certificate. Dr. Hodges, he submitted, must appear to give evidence in the case.

Mr. O'Rorke—The Act of Parliament says he must not.

Mr. Williamson would allow the certificate to be read, a note being taken of his objection.

Mr. O'Rorke then read Dr. Hodges's certificate, as follows:—

Belfast, March 3, 1875.

I certify that a sample of milk received by me on the 2nd instant, in a bottle sealed with the seal of Antrim Union, was adulterated by the addition of 34 per cent of water, but contained no substance injurious to health. The specific gravity of the milk was 1.022. It gave only 3 per cent of cream, and contained only 7½ per cent of solid matters, while pure milk of the poorest quality yields 11½ per cent of solid matters.

JOHN F. HODGES, M.D., F.C.S.,

Public Analyst, Country Antrim.

After reading Dr. Hodges's certificate, Mr. O'Rorke said he could hardly trust himself to comment on the atrocity of this case—the supply of this milk to these unfortunate paupers. He could hardly believe that any person could be found in this country having the hardihood to contract to supply a workhouse with milk, and would send in such stuff as this. He would ask the Court, after they heard the evidence, to impose as high a penalty with costs as the law permitted them to do.

The Master of the Antrim Workhouse was then examined, and said that, on the 2nd of March, he put a quantity of the milk supplied by Mr. Harper into a bottle, and sealed it. He proceeded to Belfast, and delivered this sample to Dr. Hodges.

Witness was cross-examined.—No person interfered with the sample from the time he took it until it was delivered to Dr. Hodges.

The Matron was then examined as to the non-interference with the sample until it went to Dr. Hodges.

Mr. O'Rorke proved to seeing Dr. Hodges writing the certificate.

Mr. Williamson submitted that on two grounds the case for the prosecution must be dismissed:—First, that the certificate of Dr. Hodges could not be relied on as evidence, and that that gentleman should be present to submit himself to cross-examination. Second, that the defendant had entered into a bond with the guardians to supply milk of a certain specific gravity, and in failing to do so they were to impose a penalty. They had inflicted

penalties on the defendant, and therefore he could not be punished twice for the one offence.

Mr. O'Rorke replied to Mr. Williamson's arguments, after which—

The Magistrates said they had given this case a great deal of consideration, and they were of opinion that the adulteration had been proved. They decided that Dr. Hodges's certificate was evidence, and according to that certificate the milk was adulterated by the addition of 34 per cent of water. The defendant had contracted to supply pure milk at 1s. a gallon, and of course his profits on that would be according to the quantity of water he put in the milk. Under the 23rd and 24th Vic., chap. 84, they had come to the conclusion that the defendant should be fined in £5, and also that he should pay £6 16s. costs.

CORRESPONDENCE.

MANUFACTURE OF CAUSTIC SODA.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS, vol. xxxi., p. 145, Mr. Morrison suggests an experiment should be made with a view of depriving the lime mud of its water and re-burning it so as to use it over and over again. In the year 1840 I worked at it with that object without success; the difficulty is that it falls to powder, and the price of coal in London precluded me from treating it in a reverberatory furnace.—I am, &c.,

J. B. ANDERSON.

Soap Works, Southwark, April 5, 1875.

DOUBTFUL MINERALS.

To the Editor of the Chemical News.

SIR,—Your correspondent T. A. R., in articles which he has communicated to your Journal, gives me more credit than is my due, and in an uncivil way brings me into collision on a point of trifling importance with the excellent Mineralogist of the British Museum, Prof. Maskelyne.

The system in mineralogical nomenclature of which he complains is not of my making. In his letter (CHEMICAL NEWS, vol. xxxi., p. 107) speaking of the names of species, he says:—"Chalcopryite is authoritatively flashed by cablegram from Yale College," &c., "Dana all the while sheltering himself under the popular notion that the Greek language is the most approved source for names." Now, with the amount of knowledge that becomes well a teacher in science, your correspondent should not have thought of Dana or Yale College, but have written thus:—"Chalcopryite is authoritatively flashed by typogram from Beudant's "Traité de Mineralogie" of 1832, Haidinger's "Handbook" of 1845, Von Kobell's "Mineralogy," and also from nearer home, even from Nicol's "Manual of Mineralogy," published at Edinburgh in 1849, from Greg and Lettsom's "British Mineralogy" of 1858, and in fact from nearly all recent works on the subject, Brooke and Miller's excepted, which strangely substituted the still more meaningless *townite*, and their authors are all alike blockheads. "I half blush to say it," for "*yellow copper ore* is a distinctive expression wherever English is spoken, and those who like it will continue to use it whilst the ore is of any value in the mineral market." That would have decided the thing, for all would have appreciated the force of the argument.

In the adoption of the scientific names of minerals used in my treatise, I have simply followed the best authorities, and the usual law as to priority. The objection urged to names from a Greek or Latin source, is the old one of uninformed minds against all scientific nomenclature. The object secured by such names is uniformity the world

over through all languages. *Copper pyrites, yellow copper ore, cuivre pyriteux, cuivre jaune, kupferkies, gelferze, gelbes kupferkies*, are some of the many names that were used for this species before the science had accepted of *chalcopyrite* for universal use. Works on mineralogy give the common names as well as the systematic; and no mineralogist is ever disposed to quarrel with the miner, or any other person, for saying, as often as he chooses, "yellow copper ore."—I am, &c.,

JAMES D. DANA.

Newhaven, Conn., March 23, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 9, March 1, 1875.

Certain Problems of Molecular Mechanics.—M. Berthelot.—The author describes the butyrate of soda as the starting-point of his considerations, and examines the heat liberated by the anhydrous salt and its hydrates during solution, the successive states of the dissolved salt, and the formation of crystalline hydrates.

Experiments on the Artificial Imitation of Native Magneto-Polar Platinum.—M. Daubrée.—It is well known that certain specimens of native platinum not only act upon the magnetic needle, but are themselves polar, in the manner of true magnets. These native platinum magnets, according to M. de Koksharrow, are capable of withdrawing a considerable quantity of ferruginous grains from the auriferous sand of the Ural after an ordinary load-stone ceases to have any effect. A similar magneto-polar platinum was produced by fusing the metal with a small quantity of iron.

On Magnetism.—Th. du Moncel.—The property of magnetism of not readily penetrating into the whole of a magnetic mass explains easily the law of the proportionality of the attractive forces of electro-magnets to the diameters of their nuclei. This law is in relation with their surface rather than with their mass, and explains the great power which the author has developed in a tubular electro-magnet with a nucleus 10 centimetres in diameter, a tube 1 centimetre in thickness, and with arms 30 centimetres in length. This electro-magnet, with a single Bunsen element, and with only 482 folds of wire of 4 m.m. diameter, exerted an attractive force of 160 kilos. The force was slightly increased with 5 Bunsen elements, but it was not further perceptibly increased even with 20, because the magnetic mass was no longer in relation with the electric energy.

Purple Colouring-Matter derived from Cyanogen.—M. G. Bong.—Already noticed.

Determination of Boracic Acid, and its Separation when found along with Silica and Fluorine.—M. A. Ditte.—Already noticed.

Reciprocal Displacement of the Volatile Fatty Acids.—M. H. Lescœur.

Calculation of the Moments of Maximum Inertia of the Molecules of the Chlorinated Derivatives of Toluene.—M. G. Hinrichs.—A mathematical paper; not adapted for abstraction.

Study of the Amounts of Heat Liberated in the Formation of the Potash-Salts of Certain Acids of the Fatty Series.—M. W. Louguinine.—The author draws the following conclusions:—That the amounts of heat disengaged in the formation of the potash-salts of acids of the fatty series seems to increase as we ascend the homologous series; the two isomeric butyric acids

liberate about the same amount of heat, both when dissolved in water and when they react on potash. The two valerianic acids, that from valerian and that obtained by oxidation, liberate also quantities of heat, which differ little in presence of water.

"Hygrodeik" Psychrometer, Obviating all Necessity for Calculation.—M. Lowe.—Two thermometers, on the same stand, are fitted with a graphic table, which permits the observer to find rapidly the evaluation which he requires.

New Burette.—M. A. Pinchon.—The Pinchon burette is fixed almost horizontally upon two supports. Air is forced gradually in at the top by means of a screw acting upon a caoutchouc receiver adapted to a flexible tube, and the liquid is forced out by drops.

Moniteur Scientifique, du Dr. Quesneville,
January, 1875.

Process Employed in the Royal Works of Freiburg for Freeing Sulphuric Acid from Arsenic.—M. F. Bode.—A very valuable paper, which, however, cannot be made intelligible without numerous illustrations.

Determination of Copper and certain other Metals by the Electrolytic Process.—Taken from the *Bulletin de la Societe d'Encouragement*.

Researches on the Methods of Determining Phosphoric Acid, conducted at the Agricultural Station at Halle, on the Saale.—O. Abesser, W. Jani, and M. Maercker.—The results of the authors, as far as the gravimetric methods are concerned, may be summed up as follows:—For precipitation with molybdate of ammonia a quantity of the sample is taken, containing from 0.1 to 0.2 gm. of phosphoric acid. The bulk of the liquid should be from 50 to 100 c.c. The molybdic solution is prepared according to Fresenius, by dissolving 150 grms. molybdate of ammonia in 1 litre of water, and pouring this solution into 1 litre of pure nitric acid. The quantity of solution used should be such, that for 1 part of phosphoric acid there may be about 50 parts of molybdic acid. As the ammonium molybdate of commerce contains about 83 per cent of molybdic acid, about 100 c.c. of the above solution are required for 0.1 gm. of phosphoric acid. A large excess of molybdic acid is not a direct obstacle to the exactitude of the operation, but it is a hindrance not to be desired, since a certain quantity of free molybdic acid is almost always deposited, which does not easily re-dissolve in ammonia. It is sufficient for the complete precipitation of the phosphoric acid to let the mixture digest for four to six hours at 50° C. After cooling, the yellow precipitate is filtered, and washed with a mixture of solution of molybdate of ammonia and water, equal parts. The yellow precipitate of phospho-molybdate of ammonia is dissolved upon the filter with dilute *hot* ammonia, 1 part of commercial ammonia to 3 of water. It is necessary to neutralise the excess of ammonia with hydrochloric acid. Chloride of ammonium is formed, an excess of which is not desirable; hence, the yellow precipitate should be dissolved in as little ammonia as possible. Hydrochloric acid is added to the ammoniacal solution as long as the precipitate formed re-dissolves quickly. The liquid must then be cooled before adding the magnesian mixture, for, if hot, basic salts of magnesia are sometimes thrown down, and increase the weight of the result. The magnesian mixture is prepared with 110 grms. of crystalline chloride of magnesium, 140 chloride of ammonium, 700 of liquid ammonia, and 1300 of water. To precipitate 0.1 gm. of phosphoric acid, we require 10 c.c. of this mixture. The presence of soluble magnesian salts diminishes the solubility of the double phosphate of magnesia and ammonia. After adding the magnesian mixture, we pour in one-third of its volume of concentrated liquid ammonia. The total bulk of the liquid should not exceed from 100 to 110 c.c. In three or four hours the precipitate is ready for filtration.

The precipitate is washed on the filter with dilute ammonia (3 : 1) until chlorine can no longer be detected in the filtrate. No subsequent correction is needful. When dry, the precipitate is removed from the filter (which is burnt separately). The flame must be feeble at first, and be gradually increased. It is finally ignited with the gas blowpipe.

Brief Description of the Systematic Course of the Volumetric Analysis of a Superphosphate.—20 grms. of the sample are treated with water in a mortar. The lumps are broken up without pressing them strongly, and the whole poured into a litre-flask, which is filled with water up to the mark, closed with a stopper, shaken briskly for some minutes, and filtered immediately. This method of extraction is not applicable to superphosphates prepared from Lahn phosphorite, which must be extracted by washing on the filter (see Fresenius, Neubauer, and Luck). The filtrate is examined with acetate of sodium to find if there is a precipitate of phosphate of iron. If there is a precipitate, 200 c.c. of the filtrate are mixed with 50 c.c. of a solution containing per litre 100 grms. of crystalline acetate of soda, 100 grms. of concentrated acetic acid, equivalent to 30 or 40 grms. of glacial acid. Filter to separate the precipitate, wash on the filter three or four times in boiling water, ignite in a platinum crucible, and calculate 0.47 of the final weight as phosphoric acid. The liquid filtered from the precipitate of phosphate of iron is then titrated; 50 c.c. of this represent 40 c.c. of the original solution. If there is no precipitate of phosphate of iron, titrate 50 c.c. with uranium solution, after the addition of 10 c.c. of a mixture of acetate of soda and acetic acid. The acetate of soda and free acetic acid are not without influence upon the appearance of the final reaction of uranium with ferrocyanide of potassium. It is therefore necessary in titrating the uranium solution with phosphate of lime to add the above mixture in a quantity exactly equal to that used for superphosphates.

Titration of the Uranic Solution.—500 grms. of nitrate or acetate of uranium (crystalline) diluted with water to the bulk of 14 litres, yield a solution, of which 1 c.c. precipitates about 5 milligrms. of phosphoric acid. Nevertheless it is prudent to take an excess of 25 to 30 grms. of the uranic salt, since there remains almost invariably a deposit of insoluble basic salts. As the nitrate always contains free nitric acid we add, to neutralise it, acetate of soda in the proportion of 50 grms. to 500 grms. of the uranic salt. To the acetate we add, per 500 grms., 50 to 100 grms. of concentrated acetic acid, which renders the solution of the salt more stable. It is needful to let the uranic solution stand some days before filtering, since the deposition of the basic salt does not take place immediately. It is best to standardise, not with sodic phosphate, but with an acid calcic phosphate; thus reproducing, as far as possible, the circumstances to be dealt with in the analysis of superphosphates. To prepare the liquid for titrating the uranic salt, digest 5.5 grms. of tribasic phosphate of lime with dilute sulphuric acid, containing 2.85 to 2.90 grms. of SO_3 . The authors employ for this purpose the dilute sulphuric acid serving for the determination of nitrogen by Will and Varrentrapp's method. After digestion the mass is taken up with water, and diluted to 1 litre. It is then filtered to remove sulphate of lime, and the small quantity of basic phosphate of lime which has not been dissolved. It is more convenient, and quite as exact, to dissolve the pure basic calcic phosphate in a slight excess of nitric acid, and to determine the amount of phosphoric acid contained in the liquid by adding ammonia, and igniting the precipitate. It must not be forgotten that tribasic phosphate of lime, though it appears dry, still contains 10 to 15 per cent of moisture, account of which must be taken in preparing the solution for standardising. 50 c.c. of this liquid contain about 0.125 gram. of phosphoric acid, and are precipitated by 25 c.c. of the uranic solution prepared as above directed. For the titration itself take 50 c.c. of the solution, *i.e.*, as much phosphoric as there is in the solution of a super-

phosphate at 12½ per cent (of which 20 grms. form 1 litre of solution); add 10 c.c. of acetate of soda, and run in the uranic liquid into the cold solution till the reaction begins to appear. Then boil, and try the reaction of ferrocyanide of potassium with a drop of the liquid upon a porcelain plate. To have the final reaction very distinct, dry pulverised ferrocyanide of potassium must be used. A quite freshly prepared solution also gives a distinct and regular reaction, but an old one does not. The solution of superphosphate is determined in the manner just described, in 50 c.c. With very rich superphosphates the final reaction loses somewhat of its distinctness, from the uranic phosphate which is abundantly precipitated. To avoid this inconvenience, take 25 c.c. in place of 50, and dilute with an equal volume of water.

Losses of Nitric Acid in the Manufacture of Sulphuric Acid.—M. W. Hasenbach.—This paper has been already noticed.

Researches on the Decomposition of Certain Salts by Water.—M. A. Ditte.—Noticed elsewhere.

Applications of Indigo.—M. A. Schultz.—Reserved for insertion in full.

Extract of Indigo.—M. P. Hubert.—It is well known that extract of indigo is sodic sulphindigotate, precipitated from a sulphuric solution of indigo by means of soda crystals and chloride of sodium. The product, after being washed more or less perfectly, often still contains a greenish matter, which is visible if a little of the extract is spread out on filter-paper. To assay a sample, two grms. are dried in a stove. The loss in weight shows the quantity of water present. The residue is ignited, and weighed to find the mineral matter. The amount of indigo is shown by the difference. According to M. Girardin, the extracts of commerce are divided into single, double, and treble, according to their strength. The following is the mean composition:—

	Water.	Indigo.	Salts.
Single extract ..	89.0	4.96	5.7
Double extract ..	85.0	10.20	4.8
Treble extract ..	73.7	12.40	13.9

The following results have been obtained with commercial samples at Rheims:—

	1.	2.	3.	4.	5.	6.
Water	84.5	89.7	82.65	91.15	88.6	87.2
Indigo	10.6	5.6	9.55	6.05	8.2	8.4
Salts	4.7	4.7	7.80	2.85	5.2	4.4

But the dyer has still to make comparative trials with a solution containing 1 gram. per litre of the sample, and with a similar solution of a standard quality. The shades must be compared in the colorimeter; two swatches of merino of equal weight must be dyed, sulphate of soda and sulphuric acid having been previously added, and a decolourisation assay must be made with a standard solution of potassic permanganate, containing 0.5 gram. of the crystalline salt per litre.

Influence of the Presence of Nitrogen in Textile Fibres on the Direct Fixation of the Aniline Colours. M. E. Jacquemin.—The author shows that gun-cotton takes up magenta in the same manner as do silk and wool. On the other hand, oxamide could not be dyed in a solution of magenta at 80°.

Liebig's Annalen der Chemie und Pharmacie.
Band 175, Heft 3, Jan. 23, 1875.

On Amidoid Derivatives of Hydroxylamin.—This paper is divided into five sections, namely:—On the Formation of Diphenyl-urea from Dibenzhydroxamic Acid, and the Transformation of Benzoic Acid into Aniline, by H. Rotermund; On the Structural Formulæ of Hydroxylamin and its Amidoid Derivatives, by W. Lossen; On the Distillation of Dihydroxamic Acids, by F. Pieschel; On the Methods of Replacing the Carboxyl-group of Aromatic Acids by the Amid-group, by W.

Lossen; and On the Ethers of Dihydroxamic Acids, by E. Eiseler. None of these essays are susceptible of useful abstraction.

Properties of Normal Sulphobutylic Acid, and its Salts.—N. Grabowsky.—The author describes the pure normal acid, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_2\text{OH}$, as a thick syrupy liquid, in which no trace of crystallisation appears. It is readily soluble in water and alcohol, but more sparingly in ether. It readily forms salts with carbonates and hydrated oxides. The soda salt, $\text{C}_4\text{H}_9\text{SO}_3\text{Na}$, forms tabular crystals free from crystalline water, readily soluble in water and boiling alcohol. The baryta salt, $(\text{C}_4\text{H}_9\text{SO}_3)_2\text{Ba} + \text{H}_2\text{O}$ forms large foliaceous crystals which on exposure to dry air lose their crystalline water, but without any alteration in form. The author has also produced and examined the lime, lead, copper, and silver salts.

Action of Nitric Acid upon Normal Butyl-sulphide.—N. Grabowsky.—The author obtains as the result of the reaction butyl-sulphon, $(\text{C}_4\text{H}_9)_2\text{SO}_2$. He concludes that as a general law thio-ethers with normal radicals are able to form both oxides and sulphones, but those with abnormal and mixed radicals oxides only.

Synthesis of Diethyl-Carbinol, a New Isomer of Amylic Alcohol.—G. Wagner and Alex. Saytzeff.—The authors obtained this compound by adding to a mixture of 1 molecule of formic ether and 4 molecules of iodide of ethyl a little zinc-sodium, and so much dry, finely granulated zinc that it may just rise above the surface of the liquid.

New Synthesis of Secondary Butylic Alcohol.—J. Kanownikoff and Alex. Saytzeff.—The authors obtained this compound by the reaction of 1 molecule formic ether with 1 molecule iodide of ethyl and 1 molecule iodide of methyl, with the addition of zinc and zinc-sodium, as in the former paper.

An Improved Apparatus for Fractionated Distillation.—G. Glinsky.—This paper is not intelligible without the accompanying illustration.

Composition of the Platinum Compound of Dehydro-triaceton-amin.—W. Heintz.—The author demonstrates that this body is not identical with Städelers acetone-platin-chloride.

MEETINGS FOR THE WEEK.

- MONDAY, 12th.—Medical, 8
— London Institution, 5.
— Geographical, 8.30.
- TUESDAY 13th.—Civil Engineers, 8.
— Photographic, 8.
— Anthropological, 8.
— Royal Institution, 3. Prof. Duncan, "On the Grand Phenomena of Physical Geography."
- WEDNESDAY, 14th.—Society of Arts, 8.
— Geological, 8.
- THURSDAY, 15th.—Royal Institution, 3. Prof. Seeley, "On the Fossil Forms of Flying Animals."
— Royal, 8.30.
— Chemical, 8. J. W. Thomas, "On the Gases Enclosed in Coal from the South Wales Basin, and Gases Evolved by Blowers, and by Boring into the Coal itself." G. H. Beckett and Dr. Wright, "On Narcotine, Cotarnine, and Hydrocotarnine." Dr. Armstrong, "Note on Isomeric Change in the Phenol Series."
— Royal Society Club, 6.30.
— London Institution, 7.
- FRIDAY, 16th.—Royal Institution 8. Weekly Evening Meeting Prof. Gladstone, "On the Progress of Science in Elementary Schools," 9.
- SATURDAY 17th.—Royal Institution, 3. Mr. George Smith, "On the History of Assyria."

NOTES AND QUERIES.

Beer.—Would any of your readers inform me where any systematic analysis of beer (that can be relied on) is described, especially concerning the detection of the bitter principles used for adulteration?—M.B.

Testing Fibres in Cloth.—Could you kindly inform us if there is any means of testing cloth made with a mixture of cows' hair, goats' hair, and wool, so as to demonstrate what quantity of each it contains, or whether there is any wool at all in it? We want to know how to tell the difference.—R. H. S.

Anthracene.—Having recently been engaged in the manufacture of anthracene, I am anxious to gain all the information on that subject I possibly can obtain. Would you kindly inform me of the best works on that particular source of manufacture, or of tar in general, and its products?—W. F.

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THE CHEMICAL NEWS.

VOL. XXXI. No. 803.

THE EXTRACTION OF SILVER FROM CUPREOUS IRON PYRITES.*

By THOMAS GIBB, F.C.S.,
Associate of the Royal School of Mines.

"CUPREOUS PYRITES," now largely imported from Spain and Portugal to supply sulphur for the manufacture of sulphuric acid, contains silver and gold in minute proportions. These metals are obtained in solution with copper in the process usually adopted for extracting that metal, and much attention has been directed towards the discovery of cheap methods of separating them from the copper solutions.

The sulphuric acid manufacturer first burns off as much sulphur from cupreous pyrites as he finds expedient, and the residues come into the hands of the metallurgist. The relative proportions of copper and silver, in residues from the chief varieties of pyrites, are as follow:—

	Copper, per cent.	Silver, per ton.
Rio Tinto	3.80	1 oz. 4 dwts.
Tharsis	3.50	15 "
San Domingos (Mason's)	3.70	15 "

The process generally adopted for extracting copper from burnt pyrites consists essentially of three chief operations, viz.:—(1) Formation of chloride of copper by calcining the burnt ores with common salt; (2) separation of this chloride from the mass by lixiviation; and (3) precipitation of copper by metallic iron from the solution so obtained.

Silver and gold are chloridised in the calcination, and dissolved with the chloride of copper—chloride of silver being dissolved in the first washings, which contain a comparatively very large proportion of metallic chlorides, besides, in most cases, chloride of sodium.

When these solutions are digested on metallic iron, the silver and gold are precipitated with the copper, and many attempts have been made to separate economically the precious metals from the solutions before precipitating the copper, or from the copper after precipitation.

At first sight the problem appears easy; comparison with Augustin's process for extracting silver from copper regulus suggests at once digestion of the solutions on metallic copper, but before anything like complete separation is accomplished the cupric chloride must be reduced to cuprous chloride, and when dealing with solutions in which the relative proportions of copper and silver are so extremely unequal (about 1600 to 1), the slowness of the reduction of cupric chloride, and the sparing solubility of cuprous chloride, render the process quite impracticable. On this principle, Claudet† proposed to employ spongy iron slightly in excess of the proportion required to change the cupric to cuprous chloride, and Wright‡ to employ metallic copper in an extremely fine state of division. But the reduction of cupric chloride, even when spongy iron is used, is not easy on the large scale, and cuprous chloride is an extremely troublesome salt to deal with in large proportions in solutions. Neither process appears to have been found practicable. Henderson and Down|| proposed to calcine the precipitated metals, with a view to volatilise the silver as chloride and collect it in a con-

denser, and an attempt was made to work this process at the Alderley Edge Mine, in Cheshire. The process was abandoned, I believe, on its being found, after working a large quantity of precipitate, that no silver had been condensed.

Where precipitated copper is dissolved, after calcination, for the manufacture of sulphate of copper, the silver and gold are obtained from the residue left in the dissolving tanks. This manufacture being unimportant, the recovery of the precious metals by its means is of very limited application, but no other process was found practicable until the beginning of 1870, when a process patented by F. Claudet* was introduced by J. A. Phillips at the Widnes Metal Works.

Claudet's process depends on the almost complete insolubility of iodide of silver in cold solutions of metallic and alkaline chlorides, and is conducted as follows:—In lixiviating burnt ores after calcination with common salt, Phillips has found that the first three washings contain about 95 per cent of the soluble silver, and these washings only are run into settlers preparatory to silver precipitation; the remaining washings being treated directly for the copper they contain. After settling, the first liquors are run into precipitating tanks, a sample is taken from each tank and assayed for silver, and a quantity of iodide of potassium solution, calculated as equivalent to the silver found by assay, is added to the copper liquor. At the same time the liquor is diluted by about one-tenth its bulk of water, and mixed with some milk of lime, whilst the whole is kept continually stirred. Iodide of silver, sulphates of lead and lime, and subchloride and oxychloride of copper precipitate, and are allowed to settle during two or three days. From time to time the accumulated precipitate is removed, washed with dilute hydrochloric acid to remove the copper salts, and treated with metallic zinc, which decomposes the iodides with production of iodide of zinc and metallic silver and gold. The iodide is dissolved out, standardised, and employed instead of iodide of potassium in operating on further quantities of liquor. The composition of the residue is given by Mr. Claudet, as under:—

Silver	5.95
Gold	0.06
Lead	62.28
Copper	0.60
Oxide of zinc	15.46
Oxide of iron	1.50
Lime	1.10
Sulphuric acid	7.68
Insoluble residue	1.75
Oxygen and loss	3.62
	100.00

By the recovery of the iodine in combination with zinc, the cost for iodide is reduced to that required to keep up the loss in carrying on the operations, and is only a small proportion of the value of the precious metals recovered. This process has been very profitable in the hands of Mr. Phillips, who has succeeded in recovering about two-thirds of the silver, and probably a larger proportion of the gold in the ores worked in the Widnes Metal Works, since its introduction.

Other extractors have been less successful in the application of Claudet's process, and in some works the process has been abandoned after a trial. One cause of want of success appears to be the presence of cuprous chloride in copper solutions. When ores, badly burnt or otherwise refractory, are calcined in hand-worked furnaces, or when a high temperature is employed in calcination, a considerable quantity of cuprous chloride is formed. The following testings of ores from different works shows the great difference in relative proportions of cupric and cuprous chlorides in calcined ores:—

* A Paper read before the Tyne Chemical Society.
† No. 1101, A.D. 1871.
‡ No. 827, A.D. 1871.
|| No. 2525, A.D. 1860.

* No. 282, A.D. 1870.

		Per cent.			
Cupric chloride ..	6.70	4.03	4.25	3.75	
Cuprous chloride ..	Nil	0.21	0.45	0.62	

When cuprous chloride is present in copper liquors in considerable quantity, it is precipitated on dilution of the liquors, when iodide is added, increasing the quantity of precipitate, to be further dealt with to obtain the argentiferous residue; and in presence of cuprous chloride, the silver is incompletely precipitated on addition of its equivalent of soluble iodide to the liquors. In the Widnes Works great care is observed to avoid the formation of cuprous chloride, and to this care the especial success of Claudet's process in these works is doubtless attributable.

A process adopted by the Bede Metal and Chemical Company, and continuously worked for a considerable time past, consists in the precipitation of the greater part of the silver, simultaneously with a comparatively small proportion of the copper, from copper liquors by sulphuretted hydrogen. On first passing this precipitant into copper liquors, a much larger proportion of the total silver than of the total copper in solution is precipitated. The first series of experiments, in which sulphuretted hydrogen produced by the ordinary laboratory method was employed, led to the expectation that with 10 per cent of the copper 70 per cent of the silver would be precipitated. But when H_2S , much diluted, was blown through the liquors, producing a violent agitation, a much more perfect concentration of the silver was obtained. In practice, H_2S is obtained by the action of dilute hydrochloric acid on "tank waste." The tank waste is placed in covered tanks of wood, 6 feet square and deep inside, on a bed of ashes over a false bottom of narrow boards. The acid is conducted under the false bottom, and rises through the waste to an overflow pipe, 2 feet 6 inches from the top, thus giving a large space for frothing, &c.

The sulphuretted hydrogen evolved in mixture with carbonic acid is drawn off by a blowing engine, and blown with a large quantity of air, purposely drawn in for dilution, through the copper liquors. Before blowing, a sample is taken from each tank and tested for copper, by standard cyanide of potassium solution. The blowing is allowed to go on—usually for about twenty minutes—until a sample of the liquor gives 6 per cent less copper than the first sample. All the liquor produced in lixiviating the ores is treated by this method, and boys, testing without analytical training, are able, with the aid of a table, to come very near the precipitation of any percentage of copper that may have been decided on. The precipitate is allowed to settle, and the liquors are drawn off to the copper precipitating tanks. The precipitate is run off into washing tanks, where as much of the copper solution is removed as is practicable, and the precipitate is at last collected in a filter on the Needham and Kite plan, but with chambers of more than twenty times the usual capacity.

The following are the average testings of the liquors and precipitate:—

	Copper, per Litre.	Silver, per Ton of Copper.
	Grms.	Ozs. Dwts.
Original solutions ..	20.1	18 0
Desilverised solutions..	18.8	2 19
Precipitated by H_2S ..	1.3	220 0

The washed argentiferous sulphide is not quite free from chlorides, and in the next operation, viz., calcination at a low temperature, chlorides of silver and copper are produced with oxide and sulphate of copper. The calcined precipitate is ground to a rough powder and lixiviated, first with water, which dissolves the sulphate of copper with only a trace of silver, and subsequently with hot solution of common salt, which dissolves out the chloride of silver. The latter solution always contains copper and some sulphate of lead. This solution is mixed with milk of lime and the precipitate well washed, to free it as far as practicable from chloride of calcium, after which it is digested

in dilute sulphuric acid to separate the oxide of copper, and again washed. After drying, the residue has the following composition:—

Silver	8 77
Oxide of lead	28.66
Oxide of copper	3.75
Peroxide of iron	2.61
Lime	13.67
Sulphuric acid	31.72
Chlorine	4.70
Water	4.20
Insoluble residue.. ..	1.40
	99.48

The method described of separating the silver from the precipitated sulphide of copper is somewhat complicated, but it has been adopted, after several modifications, as the most economical. The quantity of material to be treated in the latter operations being comparatively small, requires very few men, and otherwise is not expensive.

The proportion of silver recoverable from burnt ore—about 1 part from 60,000—although extremely minute, yet amounts in value in Tharsis and Mason's ores to 2s. 6d. per ton, whilst the cost of extraction, by either Claudet's process or the process last described, is about 10d. per ton of ore worked; and when it is considered that 350,000 tons of such residues are produced annually, the aggregate value of the precious metals recoverable by these processes cannot be regarded as unimportant.

ON THE WIDE DIFFUSION OF VANADIUM AND ITS ASSOCIATION WITH PHOSPHORUS IN MANY ROCKS.*

By A. A. HAYES, M.D.

CHRISTIAN KEFERSTEIN, as early as 1834, had boldly stated the proposition that "all crystalline non-stratified rocks, from granite to lava, are products of the transformation of sedimentary strata," and later researches aid in confirming the truthfulness of this view.

Simply considered, all rocks consist of a basis material, generally simple minerals, such as compound silicates, aluminates, or even quartz, in various states of division, united by a compound which acts the part of a cement, which through its composition is more easily acted on by ordinary agents than the particles of the mineral it unites.

This part of every rock engages attention, also, from its acting as a positive compound does in a simple mineral. It is complex in composition; usually it consists of silicates of protoxide basis. At one moment of time it binds the particles with great force; at another, under altered conditions, it relaxes its bonds, itself losing cohesion, crumbling and becoming an earth containing the elements necessary to vegetation, while the bonded materials drop to their condition before union.

Accepting Keferstein's expression in its fullest sense, I have applied the resources of analysis to a large number of rock aggregates, and the results of my experiments have shown the interest and extent of this field of inquiry. To do this, I have departed from the ordinary course of analysis, and applied a principle which, many years since, enabled me accurately to separate alkalies from mineral compounds. This principle is the adaptation of a definite mixture of agents, so that while one part of the mixture is searching for and dissolving the substance to be studied, the other part is holding in a semi-fluid state the larger part of the substance and allowing any reactions or adjustments of composition to take place. The subsequent solution and boiling determines the precipitation of

*From the *Proceedings of the American Academy*, Presented January 12 1875.

compounds not soluble in the medium. This medium is subsequently decomposed and products divided.

Mode of Analysis.

The rock perfectly cleansed by washing and brushing, reduced to fine powder, is either dried for its combined water or taken in its natural state. A flux is prepared by melting 202 parts of potassic nitrate with 53 parts of sodic carbonate, both pure. The cooled mass, reduced to powder, absorbs about 0.004 part when exposed to the air, and must be kept in a closed bottle. This *basis* flux can be adapted to meet all cases of varied composition in minerals. 1 grm. of the rock or mineral is mixed intimately with 1.28 grms. or 2 grms. of this flux in a tall, narrow crucible of platinum, on which no action is exerted. The crucible, covered, is heated over an ordinary Bunsen table lamp, gently while intumescence continues; the heat increased, hissing ceases, a slow sintering follows, and in 12 to 20 minutes the action is over, about one-half the whole power of the lamp being used.

The fused mass, mostly removed from the crucible by a looped platinum wire, with the crucible and cover, are boiled in water. The basic silicates, more or less altered, remain; the soluble compounds dissolve, and the filtered solutions and washings, making 40 to 50 c.c., are evaporated in a platinum basin to about 6 c.c. To the hot solution, ammoniac chloride, a little in excess of the equivalent of sodic carbonate used, is added, from a titrated pure solution, the basin put on a water-bath, the contents evaporated, and carefully dried at a temperature not exceeding 100° C. After the addition of the ammoniac chloride, the silicic acid gelatinises, and, in drying, passes out of combination with the alkalis. By subsequent boiling in water and filtration, the precipitated silicic compounds are obtained.

The filtrate and washings contain other combinations, which can be treated either in the normal state of acid ammoniac salts, or after the addition of a drop of ammoniac hydrate renders the solution neutral to test-paper. Numerous cases occur, rendering modifications necessary. Chlorine, bromine, iodine, sulphur, compel a choice of ammoniac salts. Many of the acid-forming metals are separated by their characteristic reactions, from the residue of fusion. In general, if the solution of the result of fusion does not deposit silicic acid on the addition of an ammoniac salt, 0.25 grm. of silicic acid, with or without its equivalent of sodic carbonate, is added; because the displacement of other acids depends on the presence of an excess of silicic acid. The solution containing nitrites is delicately balanced, but it is always adapted to the statical determination of phosphoric acid by the magnesia mixture, or its estimation volumetrically, in using uranic nitrate. The quantity of phosphoric acid present in mineral or artificial forms of compounds can thus be accurately obtained, and the most compact aggregates do not resist solution.

Wide Distribution of Phosphorus.

In applying this mode of analysis to a great variety of rocks, it soon became evident that phosphoric acid is widely distributed. In some cases, the *basis*, as well as the cementing part, of a rock contained it, so that adherence to the plan of seeking it in classified rocks was not possible. Associated with silicates of the more basic earths and the protoxides of metals, it is found in all the clays, the new and old lavas, trachytes, slates,—from the most fissile to the most compact—shales, ashes of coals; in the rocks formed of quartz, felspar, and mica; in aggregates where felspar is replaced by quartzite, and in those containing chlorite. The well-known conglomerates of Roxbury, and a siliceous slate reposing near it, contain phosphates.

In the opaque felspars, the ancient porphyries of Rome and Carthage, phosphates occur; but the glassy and rose-coloured varieties have not afforded it. The lepidolite of Paris, Me., contains it; furnace products, slags from

copper and zinc, afford it. This list might be extended, without indicating to any law relating to the affinities, which may perhaps be discovered as the observations are multiplied. We have in phosphatic salts in rocks another consolidating material, and an element of change.

Vanadium Associated with Phosphorus.

In many of the analyses made after the method described, another acid was found associated with phosphoric acid, and this was easily proved to be a compound of *vanadium*. The frequency of its occurrence as acid or oxide, its well-marked characters as a changeable body, the colours of its compounds and mixtures, give great interest to this discovery. Owing to its association with proto-salts of manganese and iron in rocks, it proves to be active, first as a binding, and secondly as a disintegrating, agent. It is a matter of surprise that the dissemination of vanadium has not before been noted, especially since its later classification with phosphorus leads to such a conclusion.

When the rocks treated by the above method for phosphoric acid contain manganic compounds, if the second filtrate, balanced by ammoniac salts, has any yellow tint, vanadic acid salts are almost surely present. It occurs with phosphoric acid in most of the mineral bodies named above. The physical character of colour of the rock is the only indication I now know. The green and plum colours of slates and porphyries; the greenish epidote colour of many aggregates; the changed colours, seen in sandstones, and especially in roofing slates, from world-wide localities, are guiding marks merely. My observations have been quite numerous, and as yet no proper *ore* of vanadium has been found, but sources of economical separation have been suggested.

As vanadium occurs in many well-trodden paths, I deemed it important to devise a direct way of obtaining it, in which no metal and the fewest reagents are employed.

Process.

Crush in the diamond mortar 1 to 1½ grms. of greenish slate to a fine and coarse powder; place in a watch crystal, and wet thoroughly with a solution of one-fourth sulphuric hydrate, leaving a little excess. Expose freely to dry, warm air—sunshine, if possible; and, if the slate is acted on, after 2 to 4 days, when the mass is nearly dry, the salts formed crystallise. Under a lens, a number of green or bluish-black spherical crystalline aggregates, unlike any other matter present, will be seen. These are a double salt, in which blue oxide of vanadium exists; and from such a small weight, often, enough crystals can be picked out for showing the characters of vanadium compounds. It is best to use several differing specimens, which by their colours indicate proto-silicates, and to be sure that they have been carefully washed, as granites are often invested with a lichen of a hemispherical form. One is often surprised to see the number of these crystals extruded from the mass of salt, and formed under constraint. The oxidised rocks do not afford these crystals, but we see bands of yellow vanadium compounds, denoting the condition of the substance.

The ordinary tests of vanadium are best applied to the vanadates, and among them the gall test is delicate and discriminating. If the greenish-black precipitate it forms in acid solutions be burned, the insoluble oxide obtained (when the precipitate is entirely free from any chloride) has characteristic reactions with acids, and in the blow-pipe flame with fluxes. The salts of vanadium in mixture with manganous salts, precipitated by excess of ammoniac hydrate, afford a blue solution above the oxides, rivalling that of cupric oxide.

By oxidising the blackish-blue salt obtained by sulphuric hydrate, the yellow compounds form, and may be tested under both modifications.

The vanadate of ammonia present in the balanced solution from the silicates, by the mode of analysis described above, may be separated by over-saturating the solution

with ammoniac chloride, when ammoniac vanadate separates, although phosphoric acid is present. From the vanadate other combinations of vanadium may be formed. The solution does not then respond to the gall tests; and the ammoniac vanadate separated, when heated, leaves vanadic acid. The deposit caused by tinct. galls may be calcined for VO^2 . In testing for phosphoric acid, in this mixed solution, the magnesia mixture does not respond at once, unless the device of Wollaston be used; and, in strong solutions, plumose vanadates form. If heat is applied to the salts in mixture with chlorides, much of the vanadium will be lost. In most of the rocks containing phosphorus, vanadium has been found associated. Manganese is also a congener; and without repeating here the list of rocks, I can promise in a future paper to give a tabulated series.

In Utah, in the Tinctic District, there is a chalcedonic rock, with brown ferric and cupric ore. In the brown part of this ore both phosphorus and vanadium are abundant. The presence of vanadium, in crusts on copper rock of Lake Superior, announced some years since, by my late friend, J. E. Teschemacher, has been lately confirmed. It is present in light greyish earth-like substance of the datholite beds in the Calumet and Hecla mines. At present it appears that vanadium is as common a constituent of rocks as manganese.

Vanadic Compounds in Water.

The beautiful suburb of Boston, Brookline, owes its varied surface and scenic effect largely to *water action* in forming the gravel drift into elevations and depressions, having curved and graceful lines. This drift presents us with a magazine of rock aggregates, which not only supply the laboratory, but, in various cuttings, allow us to watch the influence of air, frost, and water on the rocks; which, stable in their beds, become changed, even rapidly, on exposure to these agencies. This gravel, permeated by air, changing under every variation of pressure, is powerfully oxidising; and the rain water, even if coloured on entering it, becomes colourless and sparkling at 8 yards below the surface. The gravel contains strata and inclined dykes of extremely finely divided micaceous earth, or "quicksand," in which the water circulates and passes to the ocean at different levels. An *average* result of partial analyses is:—1 litre affords by evaporation and drying at 100° 0.350 grm., of this amount 0.182 grm. is nearly insoluble matter; 0.168 grm. again dissolves in water, and contains, besides the ordinary salts, soluble silicates, not altered by boiling, drying, or heat of 100° C. These waters attack crystal glass, leaving an incrustation, which resists weak acids; and they seem to be free to act in re-consolidating strata. Indeed, in the deep parts of the gravel deposits, we meet with masses of rock in which solution of the silicates in water is hourly going on; and we may follow these solutions to the wells, and observe that sometimes depositions are formed on the surfaces of the rocks, over which they pass.

Vanadium exists in the water which supplies the wells of the district of the drift as a transparent, colourless solution of magnesian calcic, manganous, and ferrous silicates, phosphates, carbonates, and vanadates.

The deposit which forms in the boiling water resembles in composition the matter as taken from rocks by weak solvents, although some of these compounds remain dissolved in the water after it has been boiled.

Detection of vanadium as oxide is easily and at once effected, by dissolving the deposit formed from boiling water, by means of diluted nitric or sulphuric hydrate. In this solution, the addition of a slight excess of ammoniac hydrate, and a moment after a considerable excess of ammoniac carbonate, insures the reduction of any vanadic compound, by the manganous and ferrous oxides, and separation of other compounds than magnesian oxide and the blue vanadous oxide, which appears in solution of a rich blue colour. In a nearly closed vessel, a bright strip of zinc will withdraw vanadous oxide from the blue solu-

tion, at first as a thin bronze coating, then after a black crust.

I believe this is the first discovery of vanadic compounds in water. Before announcing it, every source of error has been scanned; and the labour of connecting the compounds with the rocks where they originate has been performed, as necessary to completeness, in the evidence.

Manganous salts have been observed in waters where humic acid has acted on rocks containing manganous carbonate, and the existence of a water of this kind is known to me; but it must be considered quite apart in composition from a water in which soluble silicates include manganous silicate as part of a compound possessing novel characters.

In concluding this brief account of results proving the existence of phosphates and vanadic compounds in the cementing material of the most common rocks, I wish it to be considered as only introductory to a wide field of interesting research.

THE TREATMENT OF COPPER ORES.

At a meeting of the Great Snowdon Mountain Copper Mining Company, held at the London Tavern on the 24th March, 1875, Mr. J. P. Wilkes (of Messrs. Wilkes Brothers, Trinity Square, Tower Hill, E.C.), made the following remarks:—

Mr. Chairman and Gentlemen,—As requested, we have much pleasure in giving some particulars of the process for the extraction of copper from its ores, in which we are interested, and which we have already explained to some of the Directors of the Company.

The process is a chemical one, but is not a mere chemical theory, for it contains nothing but well known reactions, which can be vouched for by every chemist.

It was devised by an eminent mineralogical chemist, of very extensive and practical experience, who was consulted by a well-known Italian banking-house, with reference to some copper mines in the Alps, formerly the property of the late Count Cavour. He was desired, if possible, to discover some cheap method of extracting the copper from the ores with which the property abounded, but which were so poor in copper, that he was informed that he could have no materials to work with but what he could find upon the mountain, or were contained in the ores themselves; they would not otherwise pay for treatment.

The ores were very similar to those of the Snowdon Mines, the bulk of which, as indeed is the case with by far the greater portion of the sulphuretted copper ores found in the United Kingdom, are too poor to be profitably dressed by water, owing to the extraordinary waste that accompanies all water processes, and the impossibility of extracting the whole of the copper by that method. His investigations, which were patiently continued for a considerable period, resulted in the erection of trial works; the various steps of the process were tested in every way, and having been practically demonstrated to be correct, and *commercially successful*, the bankers referred to are now expending upwards of £10,000 in the erection of extensive works to carry on their operations; and the process is now protected by patent in the United Kingdom, and the chief copper-producing countries of the world.

Two of the leading objects of the process are—(1) The conversion of the copper into a state of solution; and (2) the extraction or precipitation of the copper from that solution. The residues of the cupreous pyrites now so largely imported into England from Spain and other countries, and which are comparatively concentrated by the elimination of the sulphur originally contained in the ores, are generally chloridised or roasted with chloride of sodium (common salt) in order to render the copper they

contain soluble, and the copper is then precipitated from the solution by means of iron, which is sacrificed in the process; but chloridisation, as now performed, is too imperfect and wasteful, and the precipitation of copper by iron is far too costly to admit of the profitable treatment of low-class ores by such methods. In our process, those ores which contain sufficient sulphur to support combustion are first employed to roast themselves; but as we at present consider that the bulk of the Snowdon ores will be better treated by the second method of our process, it will not be necessary to explain the particulars of the treatment which applies best to ores of that class. The Snowdon ores would be first crushed, and mixed with a small quantity of burnt lime, and made up into any convenient shape for stacking as an ordinary brick-kiln would be stacked, or built, for burning; the mass or kiln of ore would then be burnt at a low red heat for a short time, which would require but little fuel to accomplish, and the roasted ores would then be crushed, and tipped into conveniently placed tanks or vats, containing, when the process is started for the first time, water, but which, after repeated use, will become a highly concentrated acid liquor, containing a large proportion of sulphuric acid, resulting from the burning of the ores with lime.

By the roasting of the ores in this manner with lime, the whole of the copper they contain will become converted from its original form of a sulphide or sulphuret into a soluble sulphate of copper, a chemical combination of copper with sulphuric acid; and for the information of our chemical hearers, we may mention that any small portion of copper sulphide which may have become converted into a simple oxide by inattention in roasting, will be easily dissolved out into soluble sulphate of copper in the strong acid liquor we have formed, as already stated, by our repeated washings of the various batches of roasted ore.

We have now to extract the copper from the solution; we therefore draw off the liquor into other tanks, or vats, and pass in sulphuretted hydrogen gas, which we can produce by another part of our process in any desired quantity from the material supplied by the mine itself, at a most nominal cost. Upon the introduction of the sulphuretted hydrogen into the copper solution, the copper, having greater affinity for the sulphur, instantly combines with it, and is precipitated to the bottom of the tank as a highly concentrated and pure sulphide, containing 50 per cent and upwards of copper; the hydrogen unites with oxygen and forms water, and we liberate large quantities of sulphuric acid, and thus indirectly manufacture a most powerful solvent, the free use of which is of great benefit in our already simple and economical process. The copper precipitate, unlike the unfortunate ores containing only 4 and 6 per cent, commands its full price in the market, according to the copper standard, and may be at once either smelted, or converted into valuable salts of copper on the spot, or sold as it is.

The quantity of lime required will depend upon the amount of sulphur which has to be absorbed from the ores; for the Snowdon ores it will probably average about 5 per cent of lime to the ton of ore; and our sulphuretted hydrogen, being made from the ores themselves, it will be seen that our operations possess the elements of simplicity and economy, while it may be mentioned that we shall, in addition, easily obtain a by-product, formed during the treatment, which will go far towards covering our entire cost. We have in this process a most simple and economical method of extracting copper, and the treatment of copper ores will henceforth be reduced to a mere mathematical question.

For the treatment of the Snowdon ores under this part of the process, which we call "The Lime Process," we require the following simple plant:—

Kilns, for burning lime.

Ordinary brickmaker's pug-mills, and moulds, for shaping the prepared ore into any convenient form for roasting.

A furnace and boiler, for the production of sulphuretted hydrogen.

Vats or tanks for precipitation, sheds, tools, &c., and—
An ordinary stone-breaker and crushers, which are equally indispensable for the water process as for this.

The commercial results of the treatment of the Snowdon class of ore by the process will be best exemplified by saying, that an ore yielding the extremely low percentage of only 2 per cent of copper, will (after allowing the most ample margin for mining, and getting of say 10s. per ton of ore) result in a net profit of 30 per cent and upwards, calculated upon the average standard of the copper market, while any additional richness in the ore treated will practically be almost all clear gain. The cost of the treatment of ordinary low-class copper ores after mining, by our process, may be taken to average from 10s. to 15s. per ton of ore, according to circumstances.

With reference to the application of the process to the Snowdon Mines, we think that a sum of about £3000, which will allow a moderate working capital, will be sufficient to treat 30 tons of ore per day, the capacity, we understand, of the stone breaker, and crushers already in working order on the mines, and provide for the necessary contingent expenses; and we think it would be desirable for the Company to turn their more immediate attention to the Halvans, which, being already mined and available for use, will yield the above rate of profit, even supposing they only give a result of 1½ per cent of copper; for it must not be forgotten, that in view of this process, there is, at that percentage of copper, a considerable value in them, which may be immediately realised.

The erection of the necessary works will take but little time, and immediately upon their completion, the Snowdon Mines, with attention and economy, may realise large profits, sufficient to satisfy the most sanguine shareholder, if the Company is placed upon a sound basis, and its capital reduced; while, owing to the extensive character of the mines, these profits may be still further increased, according to the amount of capital invested in the erection of additional works.

We think it may be safely assumed that, with the appliances already upon the mines, and the working capital now asked for, and, as before said, good and careful management, the treatment of 30 tons per day of ore (yielding about 2 per cent), or of Halvans (yielding about 1½ per cent of copper), would result in a net profit of about £60 per week, or about £3000 per annum; and if we can arrange to work for a day of twenty-four, instead of ten or twelve hours, as could no doubt be done, this amount of profit would be doubled; while it must still be borne in mind that, with additional plant, 100 tons per day can be treated as successfully as 30 tons.

We are now making the necessary arrangements for the application of the process on a large scale, in the working of some extensive copper mines in this country, in which we are interested, knowing, that in this age of criticism, we shall accomplish more to secure the adoption of the process throughout the kingdom, by practically demonstrating its truths and success ourselves, and then court the investigation of the mining and chemical interests, than by all the theoretical proof and argument we could bring to bear upon the subject; and until this was accomplished, it was not our intention to bring the process into public notice; actuated, however, by a sincere wish to aid our fellow shareholders in the Great Snowdon Company in their difficulties, we have willingly done so, and trust that it is not too late for the existing Company to apply it to their mines.

We sincerely hope that the property, and the opportunity of more than retrieving all its ill fortune will not be lost; for though at the eleventh hour, we think it is not too late for the mines to realise the prosperity, and the shareholders the benefits, they deserve, assuming, of course, that the opinions of Professor Etheridge and others, as expressed in their reports, be correct.

OBSERVATIONS ON THE "COMBUSTION-POINT."

By A. MITSCHERLICH.

By this term, he denotes the temperature at which the combustion of the body in oxygen becomes visible. Melting- and boiling-points have been carefully noted. It is strange that the combustion-point and the temperatures at which the mutual reaction of bodies takes place and decompositions ensue have been so little regarded. The observations for determining the combustion-point are not unattended with difficulties. In many bodies combustion begins slowly, and increases gradually until the point of ignition is reached, when all oxygen is generally taken up, attended with fire. In some bodies, the combustion- and ignition-points approximate, or even coincide.

From the experiments undertaken, the following conclusions may be drawn:—

- (1). Every combustible simple body, or every combustible compound, whose point of decomposition lies below its point of combustion, admits of the determination of the latter.
- (2). When the circumstances are the same the point of combustion is the same, and in solid bodies it is independent of the state of division.
- (3). The same simple bodies have different combustion-points for different modifications, if the latter are not changed by the elevated temperature.
- (4). Different modifications of the same atomic composition may have different points of combustion.
- (5). If bodies enter into combination the combustion-point alters.
- (6). In certain series of organic bodies the combustion-point sinks as the carbon and hydrogen increase, which in organic bodies is easily recognised by the increase of carbonic acid and water.
- (7). The combustion-point in organic compounds will throw a light upon loosely- or stably-combined groups of atoms, since in general only a part of the hydrogen and carbon burn while other compounds are separated. This points out a new method for obtaining known and unknown compounds.
- (8). If the combustion-points of the several organic compounds in a mixture are known, by keeping to the lowest of these it will be possible to determine their respective proportions by means of the amounts of carbonic acid and of water produced. The constituents of woods and similar mixtures can also be ascertained.—*Ber. d. Deutsch. Chem. Gesellschaft zu Berlin.*

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

April 10th, 1875.

Professor G. C. FOSTER, Vice-President, in the Chair.

DR. ODLING, F.R.S., was balloted for and elected a Member of the Society.

Professor H. M'LEOD communicated to the Society "*Some Observations on the Defects of the Human Eye, as regards Achromatism.*" The eye has been considered to be achromatic because it practically is so, but it is easy to offer abundant evidence of the defects of the organ in this respect. For instance, to short sighted persons the moon appears to have a blue fringe; in using the spectroscope, the red and blue ends of the spectrum cannot be seen with equal distinctness without adjusting the focussing glass; a black patch of paper on a blue ground appears to have a fringed edge if viewed from even a short distance; while a

black patch on a red ground, when observed under similar conditions, has a perfectly distinct margin. Professor M'Leod then explained that the overlapping of images in the eye produces the mental impression that there is no want of achromatism. It is interesting to note that Wollaston considered that the coloured bands of the spectrum were really divided by the black (Fraunhofer) lines, and his statement that the red end of the spectrum does not appear to have a boundary line, "because the eye is not competent to converge the red rays properly," shows that he had very nearly, if not quite, discovered the achromatic defects of the eye. Dr. Young ascribes to Wollaston the merit of having observed that, when a luminous point is viewed through a prism, the blue end appears to be wider than the red, the eye being incapable of recognising that the spectrum has the same width throughout its entire length. An excellent experiment was then exhibited, to show the relative distinctness of a dark line on grounds of various colours. A string, or wire, was so arranged that its shadow traversed the entire length of the spectrum, which was thrown on a screen by an electric lamp. When viewed from a short distance the edges of the shadow appeared to be sharp at the red end, but gradually became less distinct, until at the blue end nothing but a blurred line remained.

Dr. W. H. STONE considered that the paper was specially valuable, as suggesting a possible mode of investigating the relation between the defects of the eye and the personal coefficient of error in observation.

Professor GUTHRIE showed a kaleidoscope, devised by Mr. R. Cowper, in which the usual geometrical effects were produced by fragments of mica illuminated by polarised light.

Mr. WILSON, Demonstrator in the Physical Laboratory, South Kensington, exhibited a modification of Thomson's galvanometer, which might be readily constructed at a small expense. He used two discs of glass, and replaced the usual brass quadrants by tin-foil; the connections between the binding-screws and the quadrants were effected by fusible solder and platinum wires.

The VICE-PRESIDENT then alluded to the lamented death of Mr. C. Becker, of the firm of Messrs. Elliot, whose loss will be severely felt in every laboratory in this country.

SOCIETY OF PUBLIC ANALYSTS.

As the subject of the purity and the price of the gas supplied to the public by the different companies is becoming a matter of increasing interest and importance, the Bill now before Parliament is deserving of general attention; and in view of the probability of the appointment of "gas examiners" becoming general (for which appointments public analysts are in many cases the best qualified persons), it may not be inopportune to lay before our readers an outline of the Act in question, and a few comments on some of its chief provisions. The Act is described as one for regulating the metropolitan gas companies, and has been introduced by the Corporation and the Metropolitan Board of Works. The object of the Bill is twofold: first, to remedy the defects which experience has shown exist in the City of London Gas Act, 1868; and secondly, to bring all the metropolitan companies under as nearly as possible uniform regulations. We wish we could congratulate the two authorities responsible for the Bill on their new attempt at legislation, but truth compels us to express the opinion that a more crude and unworkable Bill has seldom been presented to the House of Commons. How far it can be modified in Committee (if it should ever reach that stage), so as to be a useful measure, remains to be seen, but we much doubt if those local authorities, who have taken the trouble to act on the powers given them by the Act of 1860, will care to be brought under the more cumbrous and expensive system

of the present Bill. We had hoped that, when so comprehensive an act as the present was proposed, it would have begun by making a clean sweep of all the older acts, and have contained within itself all necessary enactments. Instead of this it begins by repealing for all the metropolitan companies just those clauses of the Act of 1860 which were repealed for the City alone in the Act of 1868. The Act of 1868 is nominally repealed, but is reproduced with but few alterations, almost *verbatim*, some of the alterations being altogether inconsistent with parts of the Bill which are left untouched.

One of the evils which experience has shown to exist under the Act of 1868 was this, that, whenever through any circumstances a gas company could not pay a dividend of 10 per cent, they could call on the Board of Trade to appoint commissioners to revise the price to be charged for gas, so as to give the shareholders their 10 per cent dividend, thus relieving the company of all the chances of trade, and insuring them a regular 10 per cent at the expense of the public.

The attempt to remedy this defect is one of the most curious we ever remember; for while enacting that, under no circumstances shall a company pay more than a 10 per cent dividend, the Bill goes on to provide that, if a gas company charge more than 3s. 9d. per 1000 cubic feet, "for every penny or part of a penny charged in excess of such price, the dividend shall be reduced by 5s. per cent per annum."

Is it possible that the Metropolitan Board are not aware that this scheme has been proposed before, and rejected at once by the House as too monstrously unfair to be listened to? It is virtually saying to the companies, if things are dear, you shall bear the burden; if they are cheap, we will have the benefit! What inducement have the companies to exert themselves to make gas for less than 3s. 9d., if the whole benefit of their exertions is to go to benefit their customers? We venture to say that the public would have a much better chance of cheap gas, if it were made a matter of give and take; decrease the dividend if the companies increase the price of gas by all means, but if they lower it, let them increase their dividends in the same proportion. The public are surely better off with gas at 3s. 5d., though the company gets 11 per cent, than they are with gas at 3s. 9d., though the company only gets 10 per cent. We have every reason for thinking that a sliding scale of dividend, both upwards and downwards, would be equally acceptable to the companies and the public, and it is much to be regretted that the opportunity of thus making the interests of the companies and the public identical, instead of antagonistic, should have been lost. Turning now to that part of the Act, more strictly of a chemical nature, namely, the provisions for insuring a proper illuminating power and purity, we find all the cumbrous machinery of Gas Referees, Chief Gas Examiners, &c., of 1868, reproduced, but without the same excuse for their existence.

First, as to illuminating power, the common gas of all the companies is to be 16-candle, and is to be maintained at that power the whole twenty-four hours, the burner employed in testing being the much-abused London argand, a sample of which is to be deposited with the Warden of the Standards.

This is very well, and if the gas can be tested at some place in the midst of the district where it is consumed, at any time in the day, and the companies fined if it ever be found below the standard, the desired end would be secured; but, as though to do away with the possibility of securing what is required, the Bill goes on to provide that the Gas Referees shall prescribe, not only the mode of testing, but the times of testing, and also that the company may always have an officer present if they wish it, thus insuring that the companies shall always know the exact time at which the testing is to take place, and be prepared for it. After thus handing over the arrangement to the Gas Referees, the Act proceeds to a certain extent to tie their hands, by copying a provision of the Act of

1868, that there shall not be less than three tests made each day; this provision having its origin in the fact that the mean of all tests taken was to be regarded as the illuminating power for the day, and being absolutely valueless when no average is to be taken. As long as the candle is to be taken as the standard of comparison and the burner is prescribed, it is very difficult to see what is really left to the Referees under these clauses. But this is not all. In calculating the penalties for deficiency of illuminating power, the words of the Act of 1868 are strictly followed, viz., at so much per 100,000 feet on all gas made at the station from which the testing-house when the deficiency is discovered is supplied. Can anything be more monstrous? When an average of all tests was taken, and the testing made near the works, this was as good a mode as could be devised; but when the gas is tested where it is consumed, so that gas from various manufacturing stations may be mixed, and where any deficiency during the day subjects the company to a fine, to calculate that fine on the supposition that all gas made that day is equally deficient is, to say the least of it, a startling proposition.

As respects purity, the whole question is left open to be decided by the Referees from time to time. We had hoped that enough was now known on the subject to have ensured that these gentlemen should at least have had some minimum of purity laid down in the Act, beyond which they could not permit the companies to go.

We think we have said enough to give our readers a general idea of the proposed Bill. Much of a like kind might be added, but our readers can judge for themselves of the sort of Bill proposed, and the likelihood of good arising from it, by the specimens we have given.

NOTICES OF BOOKS.

Facts about Bread-stuffs; Illustrated with Extracts from the best Authorities. By B. Glasgow; Porteous, Brothers. London: Simpkin, Marshall, and Co.

THE writer of this pamphlet, in his "Introductory Note," seems to endorse the view that the present law concerning adulteration has been "harassing and embarrassing" to trade. "There have been" says he, "many prosecutions under the Act which have resulted in individual hardships, and these are much to be regretted." We cannot agree with him. Hardships to persons who sell water as milk, chicory as coffee, and magnetic iron ore as tea, we no more regret than we do the "individual hardships" which the law occasions to coiners, forgers, burglars, &c. The adulterating tradesman is simply a habitual criminal, and hitherto he has been treated far too leniently. We are sorry to find "B" quoting as a high authority, the report of the recent Parliamentary Committee on the Adulteration of Food Act. In that document truths and errors are mingled in a very dangerous manner.

From the author's concluding sentence we are likewise compelled to dissent. "However good an Act of Parliament may be for the purpose of putting down adulteration, it is more probable that it will be extinguished by the good sense and intelligence of an enlightened people who may be educated to prove all things for themselves." We do not see that adulteration can be left to be dealt with by the unaided good sense and intelligence of the people any more than can other crimes. Is the individual consumer to send portions of every article of food and drink he buys for analysis, or worse still, to analyse them himself? Is he to repeat this process till he finds a set of tradesmen who are honest? Is he then to make public the information he has gained, at the risk of having to defend endless actions for libel? Or is he to keep silent, and allow others to come to the same knowledge by the same slow and costly process? We admit that some frauds might be quickly extirpated if the public were

wiser. If people always bought their coffee in the berry, they could not be dosed with chicory. If they refused to purchase an article retail, at a figure below its price, in the wholesale market, many vile mixtures would be driven out of use. But we may give a fair price for milk, and yet find it copiously watered; or for sherry, and yet learn, to our cost, that it contains sulphate of potash and grain-spirits.

For the rest, the author gives a fair and intelligible description of the principal bread-stuffs and their applications.

A Handbook of Hydrometry. By JAMES BODELY KEENE. London: Pitman.

AN account of the construction, graduation, and use of hydrometers, with especial reference to alcoholic liquids. The author remarks in his introduction, "there are thousands who use hydrometers without the slightest mental glimpse of the principles of their construction, and to whom, in fact, they are like fetishes or talismans acting mysteriously." This is too true. We remember meeting with a practical man in the paper trade who insisted that the strength of his solutions of caustic alkali and chloride of lime could not be determined except by Baumé's instrument. We have known dyers and printers who hold that "Twaddell" must be an infallible and all sufficient guide in selecting samples of mordants, extracts of dye-woods, &c. We perceive that Mr. Keene thinks that the hydrometer should be in every house for the purpose of testing the purity of milk. This service, unfortunately, it cannot render. If we remove the cream from a sample of milk, the specific gravity rises. If we then add water, we may bring it back to its original standard. Thus the genuine article, and that which has been doubly sophisticated may give the same indications.

The author proposes a modification of Sikes's hydrometer, which appears well adapted for taking the specific gravity of non-corrosive liquids.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, March 8 and 15, 1875.

Fourth Memoir on Electro-Capillary Actions, and on the Intensity of the Forces by which they are Caused.—M. Becquerel.—The following are among the effects obtained:—The formation of fluorides of calcium in tubercular crystals on the face of a slit with a solution of chloride of calcium, separated by the slit from a solution of fluoride of ammonium. On acting with the monosulphide of sodium and nitric acid, the oxygen, which has a great affinity for the elements of the monosulphide, combines, on the one hand with the sulphur, and on the other with the sodium, whilst hyponitric acid is set free.

Alloys of Platinum and Iron.—M. H. Sainte-Claire Deville.—On analysing platin-iridium, by a method which will soon be made public, iron and platinum are united in the state of oxides intimately mixed. If this matter is treated with a current of hydrogen, oxide of iridium is reduced at common temperatures, and the iron at temperatures from 200° to 600°. The metals are then alloyed, for if digested with hydrochloric acid, a few bubbles only of hydrogen escape, and very little iron is dissolved, even when it exists in the alloy to the extent of 10 per cent. Iron and iridium are thus capable of combining at low temperatures, and the same is probably the case with iron and platinum. Under these conditions the alloy is evidently not homogeneous. Breithaupt admits the existence of

platinum ores containing 14 to 19 per cent of iron. Berzelius, only once however, found a specimen containing as much as 12.98 per cent; and M. Debray and the author have never found more than 12. Platinum may be freed from iron by cupellation in chlorine gas. If heated from 1200° to 1500° in this gas, it is volatilised in the form of brilliant crystals, and deposited in all the hot parts of the apparatus.

Researches on the Fatty Acids and their Alkaline Salts.—M. Berthelot.—Already noticed.

Anhydrous Acetic Acid.—M. Berthelot.—The author has made fresh experiments to determine the heat liberated during the transformation of anhydrous acetic acid into the hydrated acid. The metamorphosis is not immediate, as the anhydrous acid can exist for some time in presence of water, and even of soda.

Contemporaneous Formation of Certain Mineral Species, Galena, Angelsite, Pyrites, and Silicates of the Zeolite Family, especially Chabasic, in the Hot Springs of Bourbonne-les-Bains (Haute Marne).—M. Daubrée.—After describing the specimens, the author remarks that it has been hitherto found impossible to reproduce by direct experiment, especially at so low a temperature, the majority of the mineral species which have so decided a tendency to form in the springs above mentioned.

Peculiar Mode of Excretion of the Gum Arabic Produced by the Acacia Verek of Senegal.—M. Ch. Martius.—The development of the gum is promoted by a parasitical plant of the genus *Loranthus*.

Report on the Measures Proposed to Prevent the Introduction of the "Colorado Potato Bug" (*Doryphora decemlineata*) into France.

Micrographic Study on the Manufacture of Paper.—M. Aimé Girard.—The author, after referring to the researches of Alcan and Vetillart, remarks that, hitherto, investigations of this nature have been undertaken in the interest of textile manufactures rather than of paper making. He lays down the following qualifications as necessary for a good fibre for paper:—The fibres should be in length from 1.5 to 0.3 m.m., but the length should bear a high proportion to the thickness. The fibre should be elastic, its tenacity being a secondary consideration.

Action of Sulphate of Ammonia in the Cultivation of the Beet-Root.—M. P. Lagrange.—The author finds that the sulphate of ammonia is a manure favourable to the growth of beet-root, and that it increases the proportionate yield of sugar. It is easily decomposed by the plant which assimilates the ammonia, whilst the sulphuric acid is neutralised by the alkalies and the carbonates, alkaline and alkaline-earthly, of the soil.

Nodules of Wollastonite, Pyroxene Fassaite, Garnet Melanite, in the Lavas of Santorino.—M. Fouqué.—The wollastonite, and the pyroxene fassaite associated with it, are both very rich in alumina, yet well crystallised and pure, whence the alumina cannot spring from the accidental presence of some foreign mineral. The yellowish green globules, and the clear yellow isotropic crystals are still more basic than the wollastonite. The garnets are not manganiferous, and contain no excess of alumina above the amount indicated by their ordinary formula. The amorphous matter of the lava in intimate contact with the nodules of wollastonite differs little in composition from common eruptive lava.

Diffraction; Focal Properties of Network.—M. A. Cornu.—A mathematical paper; incapable of useful abstraction.

Magnetising Function of Tempered Steel.—M. Bouty.—Not suitable for abstraction.

Determination of the Quantity of Magnetism of a Magnet.—M. R. Blondlot.—Not adapted for abstraction.

Amylogen, or Soluble Starch.—M. L. Bondonneau.—The name of soluble starch is applied sometimes to

amylogen, the product coloured a pure blue by iodine, sometimes the product coloured red or violet formed under the influence of dilute acids. On studying the formation of this latter body, the author has remarked that if the liquid is dried at atmospheric temperatures, and in similar conditions, before and after the formation of the deposit, re-dissolving afterwards in cold water, the former (before formation) dissolves entirely, whilst the deposit of the latter remains insoluble. This insolubility shows that this substance is only formed in concentrated liquids. The amylaceous matter of organised seeds is soluble in cold water, and its apparent insolubility is due merely to its coating of cellulose.

Identity of the Bromic Derivatives of the Hydride of Tetra-Bromated Ethylen with those of the Perbromide of Acetylene.—M. E. Bourgoin.—Already noticed.

Amounts of Heat Disengaged in the Decomposition of the Chlorides of Certain Acids of the Fatty Series.—M. W. Louguinine.—Already noticed.

New Method of Titration.—M. F. Jean.—Taking advantage of the reactions pointed out by M. F. Weil, the author has devised a method of titration analogous to that of August Streng, applicable to the determination of nitrates, chlorates, iodates, chlorites, hypochlorites, &c.; of lead, manganese, tin, cobalt, nickel, ferrocyanide of potassium; and to the assay of the oxides of manganese, of red-lead, salts of tin, plumber's solder, and of bronzes. This method is based upon the following reactions:—If to an acid solution of protochloride of copper is added a body capable of liberating chlorine, or of passing to a lower degree of oxidation, there is formed a quantity of cupric chloride equivalent to the chloridising or reduced body—a quantity which may be readily determined by means of a standard solution of stannous chloride. Knowing the quantity of bichloride formed, it is very simple to deduce the amount of nitrate, chlorate, or peroxide corresponding. The author determines empirically the quantity of bichloride formed at the expense of the protochloride of copper by a known weight of nitrate or chlorate, &c.

Chemical Researches on the Absorption of the Ammonia of the Atmosphere by the Volcanic Earth of the Solfatara of Pouzzoli.—M. S. de Luca.—The earth of the solfatara, in the vicinity of the secondary fumerolles, by the action of air and moisture absorbs the ammonia of the atmosphere. This absorption is due to the previous transformation of sulphur and arsenic, under the influence of air and moisture, into acids, which convert the ammonia into ammoniacal salts, which, under ordinary conditions, are fixed and soluble. If preserved from moisture acids are not formed, and no ammonia is absorbed.

Reply to Two Communications by M. Béchamp on the Spontaneous Alteration of Eggs.—M. U. Gayon.—See *Comptes Rendus*, January 27th and July 21st, 1873.

Bulletin de la Société Chimique de Paris,
No. 2, January 20, 1875.

Researches on the Ureides of Pyruvic Acid.—M. E. Grimaux.—A lengthy paper; not suitable for abstraction.

Remarks on Certain Qualities of the Nitrate of Methyl.—C. Girard.—The nitrate of methyl, discovered in 1835 by MM. Dumas and Peligot, occupies at present a very important position in tinctorial industry. Carey-Lea demonstrated, in 1862, that it might be substituted for methylic iodide in most reactions, and especially in the preparation of methyl-aniline, dimethyl-aniline, &c. Subsequently this compound has been utilised by H. Levinstein in the preparation of the violet substitution-derivatives of rosanilin; by MM. Poirer and Chappat for obtaining the methylic aniline bases, such as methyl-aniline, &c.; and recently in France, Switzerland, and

Germany in the manufacture of greens derived from rosanilin violets, or of those derived directly from dimethyl-anilin violets. Since 1862 it has almost entirely superseded methylic iodide. MM. Dumas and Peligot, in their researches on methylic alcohol and its ethereal compounds, pointed out the facility with which this body ignites and explodes if its vapour is superheated. In consequence of the recent explosions in Germany and in France, the author has examined if its explosive properties could not be destroyed, or at least reduced, by the admixture of other bodies, as is the case with nitro-glycerin. He finds that many bodies, including the ethylic, methylic, and amylic alcohols, acetone, benzene, toluene, &c., under certain circumstances completely prevent the superheated vapour of methylic nitrate from detonating. A mixture of 2 to 3 parts of these bodies with 1 of methylic nitrate does not give rise to explosions, even when burned in large quantities. The author finds, also, that nitrate of methyl like nitro-glycerin can be made to detonate by percussion. A piece of blotting-paper, steeped in methylic nitrate, laid upon an anvil, and struck heavily with a hammer, produces an explosion as violent as that given by nitro-glycerin under the same conditions. But if diluted with twice its weight of acetone or of methylic alcohol it does not detonate when struck. With certain pulverulent and porous solids, such as tripoli and guhr it forms dynamites analogous to those obtained from nitro-glycerin.

Certain Salts of Vanadium.—J. N. Norblad.—Already noticed.

Compounds of Cyanide of Mercury with the Sulphocyanides.—P. T. Cleve.—The author describes the salts of potassium, ammonium, sodium, barium, strontium, calcium, magnesium, zinc, zinc-ammonium, cadmium, manganese, iron (ferrous), cobalt, nickel, cuprammonium, and lead.

Volumetric Determination of Acetates and of Acetic Acid in Presence of Mineral Acids.—M. C. Witz.—The changes of colour which methyl-aniline violet undergoes in contact with acids may be applied both in qualitative and quantitative analysis. Thus acetic acid, while it reddens litmus, has no action upon methyl-aniline violet, whilst the latter is turned a greenish blue by the smallest traces of mineral acids. Hence, vinegars adulterated with mineral acids may be easily detected, and the extent of the sophistication determined. For this purpose it is sufficient to find, with a standard acidimetric liquid, first, the point of neutrality for litmus, which shows the total amount of acids; and, secondly, the point of neutrality for methyl-aniline violet, which corresponds to the mineral acids present. If the second result is deducted from the first, the remainder shows the amount of acetic acid. Acetates may be determined by the ordinary alkalimetric process, using methyl-aniline violet as indicator, the liquid turning blue as soon as there is a trace of free mineral acid. The solution of the violet is made of the strength of 1 part in 1000.

Aniline Black with Ferrocyanide of Aniline.—M. A. Kilmayer.—The chlorate of aniline is prepared as follows:—5 parts of crystalline tartaric acid are dissolved in 10 parts of boiling water; 4 parts of potassic chlorate are dissolved separately in 12 parts of boiling water. These solutions are mixed while hot, and 20 parts of cold water and 3 parts of aniline are added. The solution turns a pale yellow colour, and stands at 67° B. A solution of hydro-ferrocyanic acid is obtained by treating 7 parts of potassium ferrocyanide with 3 parts of sulphuric acid, diluted with 14 parts of water. After some days the yellow colour disappears, and sulphate of potash deposits. To 100 parts of this solution of hydro-ferrocyanic acid are added 128 parts of water, and 20 of aniline. For a steam aniline black take 34 parts of the above solution of chlorate of aniline; 12 parts of the above solution of ferrocyanide of aniline; 34 parts of water; 12 parts of gum tragacanth mucilage, containing 128 grms. gum per litre. This colour may be thickened with starch-paste.

Aniline Ferro- and Ferri-Cyanides for Aniline Blacks.—MM. Wehrlin and Schlumberger.—Wehrlin prepares these salts of aniline in a state of purity with hydro-ferrocyanic acid, obtained by the action of tartaric acid upon yellow prussiate of potash. Aniline ferrocyanide forms thin, colourless laminæ, which gradually become yellow, and turn black if exposed to higher temperatures. It is neutral, sparingly soluble in alcohol, ether, and carbon bisulphide. It is soluble in cold water, and dissolves more freely in warm water. Aniline ferricyanide forms deep violet laminæ. It is slightly soluble in ether and carbon bisulphide, but dissolves in alcohol, aldehyd, and water. M. Schlumberger prepares aniline ferrocyanide by utilising its scanty solubility in cold water. He takes 2 parts of hydrochloric acid at 19° B. and 2 parts of aniline, and dissolves separately 2.4 of ferrocyanide of potassium in 4.2 of boiling water. When this latter solution has cooled down to 56°, the hydrochlorate of aniline, which must be quite cold, is added. After a time, aniline ferrocyanide is deposited, whilst potassic chlorate remains in solution. The former salt is allowed to drain, and preserved in a moist state, the yield being about 4.7 parts. This moist salt may be kept for some days without much change of colour, especially if protected from light. To make the black, 10 per cent of this salt is added to thickened chlorate of aniline. Ferricyanide of aniline is too soluble in cold water to be obtained by an analogous process.

No. 4, February 20, 1875.

On the Carbonyles, a New Class of Organic Compounds, and on the True Function of Ordinary Camphor.—M. Berthelot.—Not suitable for abstraction.

Researches on the Relations between the Different Tinctorial Principles of Madder, and on the Part which they play in Dyeing.—M. A. Rosenstiehl.—Abstracted in our last volume, p. 243.

Researches on Albumen and the Albumenoids.—M. P. Schützenberger.—Already noticed.

On the Perbromide of Bromated Acetylen.—M. Edme Bourgoin.—Noticed elsewhere.

Artificial Production of Monazite and Xenotime.—M. F. V. C. Radominski.—To obtain the former the author heated together in a platinum crucible 20 parts of phosphates of cerium, lanthanum, and didymium, and 150 parts of the chlorides of the same metals. The chlorides having been dissolved out with water, the oxy-chlorides with weak nitric acid, crystals of the triple phosphate were obtained after washing with water. Xenotime was obtained by fusing together 1 part of the phosphate of yttria, and 10 of the chloride of yttrium.

Bulletin de la Societe d'Encouragement pour l'Industrie Nationale, No. 15, March, 1875.

Procedures for Glazing Common Earthenware as used by M. Constantin.—E. Salvétat.—The following mixtures are recommended:—

- | | | | | |
|------|----------------------------|-------|-----|-------|
| (1). | Silicate of soda at 50° B. | .. | 100 | parts |
| | Powdered quartz | .. .. | 15 | " |
| | Chalk from Meudon | .. .. | 15 | " |
| (2). | Silicate of soda at 50° B. | .. | 100 | " |
| | Powdered quartz | .. .. | 15 | " |
| | Chalk, of Mendon | .. .. | 15 | " |
| | Borax | .. .. | 10 | " |

On Glass Hardened or Tempered so as to Resist Blows and Heat.—Pfocedure of M. Alfred de la Bastie.—Glass is said to be rendered much less fragile, and even malleable, by being heated in certain liquids or baths. Neither the nature of the baths nor the temperature requisite is stated.

On Blast Furnaces Fed with Wood, and used for Easily-Reducible Iron Ores.—P. von Tunner, in reply to I. Lowthian Bell's "Chemical Phenomena of Iron-Smelting."

Les Mondes, Revue Hebdomadaire des Sciences.

No. 7, February 18, 1875.

Notice on the Resistance and the Faults of Construction in Batteries; Platinised Contacts.—Emile Girouard.—The author points out that one great obstacle in the way of our obtaining cheap electricity lies in the defect of the contacts. The rivets which connect the zinc to the carbon are often ill-made, and after having been in use for some time they are corroded all round, and the oxidation prevents the contact from being perfect. The current, consequently, is unable to pass, unless the tension is considerable enough to overcome the bad conductivity of the oxides. The author proposes to obviate these defects by having all connections, &c., made of platinum.

The bulk of the number is taken up with a translation of a Discourse delivered before the German Association of Naturalists, by Prof. Du Bois-Reymond, to which M. l'Abbé Moigno has thought fit to append a series of notes similar in tendency to those which accompanied his version of Prof. Tyndall's Belfast oration.

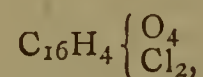
No. 8, February 25, 1875.

This number contains a note on the level of the Mediterranean at the Roman epoch; a notice of the turf-bogs of the north of France: facts showing the bad ventilation of theatres; observations on the artificial colouration of wines; and a discovery of petroleum in Algeria.

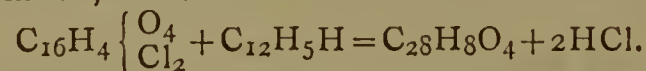
Reimann's Farber Zeitung, No. 5, 1875.

It appears, from the leading article in this number, that the dyers of Germany, and especially of Berlin, are considerably annoyed by sanitary regulations. They are compelled to collect their waste waters in tanks, and to purify them by the lime process, a method which eminent authorities consider practically impossible.

Manufacture of Alizarin.—The manufacture of artificial alizarin is much limited by the deficient supply of the raw material, since anthracen, which is converted first into anthrachinon, and then into alizarin, is only present in coal-tar to a small extent. There is now, however, a prospect of a good supply of the raw material from a new source. By the oxidation of naphthalin we obtain phthalic acid, $C_{16}H_4O_6$. Benzol, $C_{12}H_6$, is abundantly present in coal-tar. If phthalic acid is converted into phthalic chloride—



this compound, if heated for twelve hours to 220° C. with zinc-powder and benzol in a sealed glass tube, yields anthrachinon, as below:—



In this manner we obtain, not the mere raw product, anthracen, but the penultimate stage, anthrachinon.

This number further contains receipts for printing a green and white design on a dark blue ground; for a dressing for cotton; and a bright reddish blue on wool.

No. 6, 1875.

In this number Dr. Reimann denounces an evil which we attacked about eight years ago, and which appears to be no less prevalent in Germany than in England, to wit, bribery and corruption in the tinctorial trades. The technical name for sums expended in this manner is "discretion-money."

"Gentiana violet" is a new aniline colour, recommended as cheaper than the Hofmann and methyl-violets, whilst equally beautiful.

The article on the patent colours of Croissant and Bretonnière has already appeared in our columns.

There is a prescription for dyeing leather a cochineal-red.

The *Deutsche Industrie Zeitung* accuses the calico-printers of Alsace and England of sending out calicos

and battistes with white designs on a violet ground, fixed, not with albumen, but with a mixture of acetate of alumina and arsenic dissolved in glycerin. Certain goods with reddish brown and yellowish brown designs are also said to be strongly arsenical. Dr. Reimann considers the outcry exaggerated. He informs his readers that the white dots, rings, and stars on an aniline-violet ground are generally produced by dyeing the pieces one uniform violet, and then printing on discharges. At the same time he denounces the arsenical mordant altogether, and points out that, where albumen is too costly, lactarin, or glue to which a trace of chromate of potash has been added, will produce perfectly fast colours.

No. 7, 1875.

This number contains receipts for a white, a yellow, and a mode-grey on gloves; for printing a lilac-grey on woollen yarns; a bark-yellow on cotton yarns; and an orange on a vat-blue ground.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in purifying paraffin, and in apparatus therefor. John and George Miller, manufacturing chemists, both of Aberdeen, North Britain. June 12, 1874.—No. 2040. This invention has for its object the purifying of paraffin in a simple, efficacious, and economical manner, and relates to two stages of the purifying operations. In the first stage oils and constituents of too fusible a nature are removed from the paraffin wax by a draining process, aided by improved arrangements and apparatus, and in the second stage colour is removed by means of calcined sulphate of magnesia.

A new or improved artificial stone, and the modes and means of manufacturing the same. Alexander Bennett McGrigor, solicitor, Glasgow, Lanark, N.B. (A communication from James Moeller Robertson, architect, Melbourne, Victoria.) June 12, 1874.—No. 2047. This invention consists in an improved mode and means of manufacturing artificial stone, first, by taking a base (termed herein a "matrix") of sand, gravel, saingle, and stones, glass, burnt clay, and like materials either separately or mixed, and then in triturating this matrix with water, having either a chloride, a bromide, an iodide, or a fluoride, preferably in saturated solution, chloride of calcium being preferred on account of its cheapness. The material so treated is then placed into moulds, and subjected to high pressure in screw, hydraulic, or other presses, and the blocks afterwards placed on wet sand-beds, where they set or harden in a short time, the setting being accelerated by having the blocks a short time in the solution before placing them on the sand-beds.

Improvements in the manufacture of metallic alloys. Alexander Parkes, Gravelly Hill, near Birmingham, Warwick. June 13, 1874.—No. 2064. This Provisional Specification describes producing a silver-like alloy which can be rolled and worked when red-hot from copper, manganese, zinc, and sometimes nickel. A silver-like alloy, which will also work at a red-heat, is also produced from nickel, copper, and zinc. When the silver-like alloy is not required to work at a red-heat it may be produced from copper, manganese, iron, and zinc. A solder for these compounds is produced from copper, manganese, and silver.

A new or improved dry process of oxidising "anthracene," and improvements in the manufacture of dyes and other colouring matters from the product so obtained. Carl Rumpff, Glasgow, Lanark, N.B. (Partly a communication from Friedrich Bayer, Friedrich Weskott, and August Siller, all of Barmen, Rhenish Prussia.) June 15, 1874.—No. 2071. The features of novelty which constitute this invention are obtaining anthraquinone from anthracene by a new or improved dry process, and in converting the anthraquinone so obtained into colouring matters suitable for dyeing and printing.

Improvements in the method of condensing muriatic acid gas and other fumes. Robert Stirling Newall, Washington Chemical Works, Newcastle-on-Tyne. June 15, 1874.—No. 2077. The object of the invention is to produce a spray forming a kind of mist, which being introduced at the top of the condenser will mix with the gas admitted thereto and condense it. The spray is produced by causing a jet of water or other fluid to impinge with great force on a disc of larger diameter than the jet, and slightly cup-shaped.

Improvements in the manufacture of anthracene. Paul Curie, Cornhill, London. June 16, 1874.—No. 2079. Sulphur is mixed with the liquid hydrocarbons or substances, and the mixture then heated to a suitable temperature. Sulphuretted hydrogen is thus produced, and the remaining substance when distilled gives a larger proportion than has hitherto been obtained by the methods employed.

Improvements in treating fruit or vegetable juices in order to preserve the same from fermentation and decay. James Mitchell Fairlie, Glasgow, Lanark, N.B. June 17, 1874.—No. 2102. The feature of novelty which constitutes this invention is the treatment of fruit or vegetable juices by sulphurous acid gas, or by a weak solution of sulphurous acid.

Treating the juice of a certain tree called zapote or chickley in order to prepare or adapt it for useful purposes, and producing materials and useful and ornamental articles therefrom. Henry Conybeare, engineer, and Gabor Naphegyi, both of Kensington, Middlesex. June 17, 1874.—No. 2106. This invention relates to the treatment and application of

the juice of a tree called zapote or chickley, to adapt it for purposes for which caoutchouc, gutta-percha, and other industrial materials are used. The juice, or as it is termed by the inventors "Zapotine," may be dissolved in alcohol or ether; or treated with carbonic acid or other compounds of carbon; or with white-lead and sulphur. It may be distilled. It may be mixed with caoutchouc, gutta-percha, cork, or other substance. It may be bleached by sulphuric acid and chloride of lime; dissolved in benzine or other hydrocarbon; and treated by an alkali or alkaline compound.

Improvements in pipes for conveying or condensing acid gases in chemical operations. William Windle Pilkington, glass manufacturer, St. Helens, Lancaster. June 17, 1874.—No. 2111. This consists essentially in constructing such pipes, tubes, or ducts of glass, preferably of thin blown glass. In carrying my invention into practice I make one end of each glass tube or duct smaller than the one to which it is connected, either by tapering them or by the use of a socket, or I use butt- and ring-joints or other means for coupling them. In combination with the above glass-tubes I employ as supports at the junctions, or intermittently between the junctions, wood or other carriers.

An improved preparation and apparatus for testing alcohols, and ascertaining the quantity of foreign bodies mixed therewith. William Edward Gedge, patent agent, Wellington Street, Strand, Middlesex. (A communication from Jean Bonjour, Faubourg St. Martin, Paris.) June 18, 1874.—No. 2124. This invention consists in the use of a reactive composed of alcohol from grain, mixed with a certain quantity of acetate of lead. This reactive is introduced with the liquid to be analysed into a globular vessel, in which they are kept in agitation by a mixer. The liquid thus mixed escapes by the lower part of the vessel into a worm, and goes to a pressure-filter, whence it falls into a vase, where it completes its clarification. The liquid is then poured off and weighed very exactly, and by means of tables, drawn up for the purpose, it is at once ascertained whether the alcohol of wine has been mixed, and to what extent.

Improvements in the manufacture of sulphates of soda and potassa, and in apparatus employed therein. Thomas Robinson, engineer and ironfounder, Widnes, Lancaster. June 20, 1874.—No. 2145. This relates to Messrs. Hargreaves and Robinson's direct-action method of manufacturing sulphates of soda and potassa, and consists—First. In connecting the chamber containing finished chloride into the condensing tower so as to draw off obnoxious gases. Second. When a fan is used to draw gases through the chambers in employing bearings at a distance from the fan chamber, keeping the said bearings cool by liquid, add admitting the gases by preference through one eye only. Third. In constructing converting chambers with an internal air-pipe for cooling the sulphate. Fourth. In enclosing the internal pipe mentioned under the above third head in a second pipe or structure so as to surround the said pipe by an annular space. Fifth. In connecting the said internal pipe or annular passage to the chimney or artificial draft producer. Sixth. In connecting the internal pipe mentioned under the above third and fourth heads with the space in or over the cylinder and flue covers. Seventh. In hanging the carrying grids by hinge-like catches to the internal pipe mentioned under the above third and fourth heads, and supporting the outsides of the said grids by props. Eighth. In forming the internal pipe mentioned under the above third and fourth heads with flanges at or near its top, so as to support the cylinder and flue covers.

Improvements in the mode of treating phosphates of lime for manuring and other purposes. Edward Primerose Howard Vaughan, F.C.S., patent agent, Chancery Lane, Middlesex. (A communication from Count Victor Francois Leonard Huytens de Terbecq, Paris.) June 22, 1874.—No. 2168. This invention consists in the direct application of sulphuric acid to the treatment of uncrushed phosphates of lime for manuring and other purposes, when those phosphates are subjected to constant attrition in a revolving drum or other analogous apparatus.

NOTES AND QUERIES.

Testing Fibres in Cloth.—The best result would be obtained by microscopical examination. The goats' hair and the wool would be difficult to distinguish, especially in a dyed fabric; the operations of spinning and weaving often obliterate more or less the surface markings, which give the characters relied upon for distinction. Authentic specimens of the various hairs should be studied, and the changes effected by various dyes and reagents. The subject is difficult, but not so much so as in the case of vegetable fibres.

Decrease of Temperature when Certain Salts are Dissolved.—(Reply to A. S.)—All freezing mixtures depend upon this fact, which is one of the best known in physics.

Beer.—(Reply to M. B.)—Consult Prescott's "Chemical Examination of Alcoholic Liquors," published by Van Nostrand, New York.

MEETINGS FOR THE WEEK.

MONDAY, 19th.—Medical, 8

London Institution, 5.

TUESDAY 20th.—Civil Engineers, 8.

WEDNESDAY, 21st.—Society of Arts, 8.

Meteorological, 7.

THURSDAY, 22nd.—London Institution, 7.

Royal, 8.

FRIDAY, 23rd.—Royal Institution 8.

Quekett Club, 8.

SATURDAY 24th.—Physical Society, 3. J. Barrett, "On a Form of Mercurial Air-Pump." Dr. Stone, "On some Points Connected with Wind Instruments."

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THE CHEMICAL NEWS.

VOL. XXXI. No. 804.

INTERMITTENT EBULLITION.

By Dr. T. L. PHIPSON.

WATER strongly acidified with hydrochloric acid, and containing a small quantity of benzol, was found to enter into violent ebullition every sixty seconds; after a while the boiling ceased completely, and then recommenced suddenly every 30 seconds for some time. The flask still being kept over the spirit lamp, the periods between quiescence and violent ebullition dropped to 20, 10, and finally to 8 seconds, at which interval the phenomenon continued for some considerable time. The temperature of the vapour in the flask was 101° C., in the liquid 103.5° C., during the whole time of the experiment.

When methyl alcohol was added to the above mixture of water, hydrochloric acid, and benzol, and the flask placed over a spirit lamp, no ebullition at all occurred for a very long space of time, and then it took place very suddenly and continued.

ON THE MANUFACTURE OF SULPHURIC ACID IN ENGLAND.*

By Dr. LUNGE.

It is needless to say that, in the manufacture of sulphuric acid, the use of Sicilian sulphur has been abandoned. Even ordinary pyrites containing only traces of copper, or none at all, have given place to pyrites from Spain, Portugal, and Norway, containing 3 to 4 per cent of copper. Nine-tenths of the sulphuric acid made in England during 1874 were obtained from imported pyrites. The burnt ores are submitted to a chlorinising roasting process, and then washed with dilute hydrochloric acid. The copper contained in the liquid, after precipitation of the silver, is reduced to the metallic state by means of iron in a fine state of division. The portion which remains insoluble after washing is oxide of iron almost free from sulphur, accompanied, of course, by the gangue of the pyrites. The oxide may be utilised in the blast furnaces, and thus none of the constituents of the pyrites are wasted. The traces of silver found in the copper from the burnt ores are also extracted. In some places this operation is still performed on Claudet's principle; the high price of iodine, however, and the loss of this body which it involves, induces metallurgists to seek out another and a less costly procedure.

Mr. Gibb has indicated a method based upon the following observation:—When a solution of copper containing small quantities of silver is treated with sulphuretted hydrogen, the greater part of the silver is thrown down along with the first portions of sulphuret of copper. The solution of copper, obtained by washing with weak hydrochloric acid the product of the chlorinising roasting process of the burnt pyrites, is led into large troughs, and sulphuretted hydrogen, obtained from the residues of the alkali manufacture, is forced into it by means of pumps. The precipitation is stopped when about 6 per cent of the copper is thrown down in the state of sulphide. Thus, copper which originally contained 20 ozs. of silver per ton is deprived of all save 2 to, at most, 4 ozs. of the precious metal per ton. The 6 per cent of copper precipitated contains 200 ozs. of silver per ton. The solution of copper, freed from the silver, is treated with spongy iron, which throws down metallic copper. The argentiferous sulphide of copper, is deposited in the form of a voluminous mud,

which is washed and then compressed in a very large Needham filter-press. The moist sulphide thus obtained is calcined in roasting furnaces; about one-fourth is converted into sulphate, and the rest is in the state of oxide and oxychloride. All the silver appears to be found as chloride after roasting. Originally the products of calcination were converted into sulphate by means of sulphuric acid. The silver remained in the residue, which then contained 600 ozs. per ton; but the difficulty of finding a market for the blue vitriol compelled Mr. Gibb to turn to a more complicated process.

The roasted product is washed with water, and the solution, containing at most 1 oz. of silver per ton, is precipitated with iron. The residue (chiefly oxide of copper) is exhausted with a saturated solution of common salt. After this treatment it contains merely 3 to 4 ozs. of silver per ton of copper, and is treated like a copper ore, neglecting the silver.

The saline liquid contains the chloride of silver, mixed with chloride of copper. All these metals are precipitated with milk of lime; the precipitate is washed and treated with dilute sulphuric acid, which dissolves the copper. After washing, there remains a residue containing silver in the state of chloride which is sent to be smelted. Sulphates of lime and of lead derived from the pyrites are found in the same product. By this process, 1 ton of burnt ore yields about $\frac{1}{2}$ oz. of silver, costing at most 75 centimes, and representing a profit of 2 frs. 20 centimes per 1000 kilos. of burnt pyrites.

The use of pyrites involves a great difficulty—the burning of the “smalls,” which have been moulded into bricks with 10 per cent of clay. This process is defective as regards combustion, and the resulting burnt ore is difficult to treat and loses much of its value. It is preferable, in order to agglomerate the small pyrites, to stir them up with water, and spread them out to dry in a thin layer on the furnaces. A certain quantity of sulphate of iron is then formed, which agglutinates the grains of pyrites and forms them into compact masses.

The author then describes the various kinds of pyrites kilns, such as those of Spence, of Ollivier-Perret, of McDougall, and others used in England.

ON THE ANALYSIS OF CRUDE ANTHRACEN

By GEORGE E. DAVIS and T. H. DAVIS.

VERY little has been written, whatever may have been done in this country, upon the subject of the analysis of crude anthracen. The crude article is of immense importance; yet how empirically are tests made and the results issued to the buyers, which often prove anything but satisfactory. Not so long ago we had “high” and “low” analysts in the phosphate and manure trade; but the discrepancies between two analysts, or two methods of analysis, never reached the wide differences often seen in anthracen analyses, where parcels of the crude material were certified to contain so much per cent of anthracen, as calculated from the amount of matter insoluble in carbon disulphide or in alcohol, and fusing at a certain temperature, often only 1° C. short of the fusing-point of pure anthracen, and sometimes more difficultly fusible than the pure article, as against the actual amount of the pure anthracen contained in the sample.

Within our knowledge, samples have been sold on the carbon disulphide test as containing 56 per cent of anthracen which contained actually only 42 per cent. Who can wonder that there is often a loss in production in the manufacture of artificial alizarin, and why should the “test” be carried on so empirically?

It is not intended to assume that all works, all buyers, and all sellers of this article prefer the “bisulphide test,” as it is well known that some will only buy the “chinon” test; but it is a fact, that discussion upon many of these points has not publicly been entered upon with zeal and

* Abstract.

spirit, and in several large towns attempts have been made to raise a discussion upon the subject, but have failed.

The solvent methods were the first employed in anthracen analyses, and, when we remember the conservative habits of English manufacturers, it is not surprising that the processes have been so persistently retained; but the processes have many faults, and the results cannot possibly be correct, except by accident.

At the high temperature at which the oil is run into the coolers in the manufacturing operation the anthracen is in solution, and which separates, together with other substances, as the solution cools. Now, when these easily fusible hydrocarbons are liquefied, either by heat or by the aid of solvents such as those used in the quantitative analysis of the crude article, a proportionate quantity of pure anthracen is dissolved by them, in addition to the quantity dissolved by the solvent itself, so that a very different result is obtained by operating upon the original substance, in one case, and by first extracting the more easily fusible substances in the other. These hydrocarbons dissolve much more anthracen when already dissolved in carbon disulphide than when simply warmed and pressed, so that it is always advisable to press out as much as possible of the oil before treating with the solvent.

These solvent methods have been described in CHEMICAL NEWS, vol. xxix., p. 169, to which we refer, and the results of all the processes and experiments have been controlled by E. Luck's anthrachinon method, which has now been proved by Luck himself, by R. Lucas, and by ourselves, to give absolutely accurate results, as we shall show further on.

Now, starting with the carbon disulphide method. This reagent does not dissolve out all the impurities of the crude anthracen unless it is added in sufficient quantity to dissolve all, or nearly all, the pure anthracen contained in the sample, therefore the weighed residue does not give any idea of the percentage of contained anthracen, even when the fusing-point of this residue is taken; it may come near it, as it often does when the percentage of real anthracen averages 30 per cent, but these indications are not decisive.

Lucas (CHEMICAL NEWS, vol. xxx., p. 190) gives several interesting experiments in this direction. He found the carbon disulphide residues to contain the following percentages of real anthracen:—

1.	2.	3.	4.	5.	6.
49.64	53.92	55.64	56.00	59.06	60.00

The weighed carbon disulphide residues obtained by us are as follows:—

Percentages of Real Anthracen.

1.	2.	3.	4.	5.	6.
59.23	36.80	57.60	55.42	63.00	58.12

Many of these residues have been examined by the anthrachinon method; but our highest result was 63.0 per cent only, and the lowest 36.80 per cent.

Although these weighed residues contain really only from 50 to 60 per cent of real anthracen, yet we have stated that the results do come near reality sometimes, and that when the percentage of anthracen averages 30 per cent. This is caused by an error in the opposite direction, viz., the solubility of the anthracen itself in the carbon disulphide, and we purpose first to examine this solubility and see how it will affect the results of an analysis.

In the bisulphide method, 10 grms. of the crude article come in contact with 60 c.c. = 76 grms. of carbon disulphide. Now, Kopp and Bolley, in their treatise "On Tar Colouring Matters, state that 100 parts of carbon disulphide dissolve 1.7 parts of anthracen; but we will take Dr. Versmann's numbers, say, 1.5,* as they nearly coincide with our own determinations.

The 60 c.c., therefore, of carbon disulphide used will dissolve, by its own solvent power, 1.14 grms. of pure anthracen, and this is dissolved from 10 grms. of substance; so it will be seen that this error introduced is very great. Lucas, in the paper we have referred to, dilates upon this subject, and our experiments confirm his results.

A sample of crude anthracen containing 25.30 per cent by anthrachinon was examined also by the bisulphide method, which gave 21.50 per cent insoluble, and which in itself contained 59.23 per cent of real anthracen. This shows—

21.50, containing 59.2 per cent = 12.72 anthracen insoluble.
78.50, " 16.02 " = 12.58 " soluble.

25.30

Or 1.258 grms. which have dissolved in the 60 c.c. of carbon disulphide.

A second experiment gave as follows:—

Percentage of real anthracen by anthrachinon, 30.13.

By bisulphide residue, 25.20 per cent; and this residue contained 57.18 per cent of real anthracen.

This shows—

25.2, containing 57.18 per cent = 14.41 anthracen insoluble.
74.8, " 21.01 " = 15.72 " soluble.

30.13

Or 1.572 soluble in the 60 c.c. carbon disulphide.

Thus it may be seen that, in samples containing a large proportion of easily fusible hydrocarbons, one error compensates the other; but if the crude article has been relieved of a large proportion of readily fusible matters, by pressure or what not in the manufacture, the error of solubility ceases to compensate for the increase in substances left insoluble in the carbon disulphide, and a higher result is obtained than corresponds to the amount of pure anthracen in the sample.

About 31 per cent seems the point of neutrality, the point at which one error almost exactly balances the other, and as a proof we offer a few analyses:—

	By CS ₂ .	By Anthrachinon.
1.	31.57	31.17
2.	31.19	31.18
3.	30.10	29.61
4.	31.24	31.00

The neutral point of Lucas is at 16 per cent; this, in most samples of crude anthracen, we are persuaded is too low. With some varieties of tar this might happen, and possibly this neutral point would vary with every kind of tar, and with the way in which it is worked.

We will now pass to the alcohol method, and here we shall find a greater variation from the truth than with the bisulphide method. The constituents of crude anthracen are not dissolved by alcohol so readily as by carbon disulphide, consequently we have a larger residue and higher results. The residue insoluble in alcohol contains about the same percentage of real anthracen as that from carbon disulphide.

In the alcohol method of analysis 20 grms. of the crude substance are in contact with 400 c.c. of alcohol of sp. gr. 0.825 to 0.840, and it is almost needless to add, since it has been pointed out by Dr. Versmann in his lecture before the Society of Arts, that an alcohol of high gravity leaves a larger residue than a more anhydrous one. Now, 400 c.c. of alcohol 0.825 sp. gr. weigh 330 grms., which will dissolve 1.894 grms. of pure anthracen, and this from 20 grms. of the crude substance; we will therefore see, by direct experiment, how much real anthracen is dissolved out by the alcohol, and how much is contained in the insoluble residue.

In one experiment the crude substance contained 25.30 per cent of real anthracen, and by the alcohol method left 40.84 per cent of residue. This residue in itself contained 56.8 per cent of real anthracen, and this shows—

40.84, containing 56.8 per cent = 23.19 anthracen insoluble.
59.16, " 3.56 " = 2.11 " soluble.

25.30

In another experiment the crude material contained 30.13 per cent of real anthracen, and the alcohol method

* CHEMICAL NEWS, vol. xxx., p. 204.

left 30.0 per cent of residue, which contained 84.4 per cent of real anthracen. This would show—

30.0, containing 84.4 per cent = 25.32 anthracen insoluble.
70.0, „ 6.87 „ = 4.81 „ soluble.

30.13

As 20 grms. were operated upon in either case, 0.422 grms. of real anthracen entered the solution in the first experiment dissolved by the 400 c.c. of alcohol, and 0.962 grm. in the second. But we have ascertained that 400 c.c. of alcohol at 0.825 sp. gr. dissolves 1.894 grms. of anthracen; therefore it would appear that in the presence of the other constituents of crude anthracen the solvent action of the alcohol was retarded.

The constituents, other than anthracen, in the crude material are not soluble to the same extent in the prescribed quantities of alcohol and bisulphide, substances which are very soluble in bisulphide and are not taken up so freely by alcohol, and *vice versa*. We have taken advantage of this in preparing pure anthracen, and shall allude to it again in another portion of this paper. The filtrate from an alcohol analysis was taken, which left 54.96 per cent of residue.

(a). 100 c.c. were evaporated at 100° C. The result was a dirty looking greasy mass, fusing about 100° C., and losing weight at that temperature.

(b). 100 c.c. were agitated with 100 c.c. of carbon disulphide, and separated by a stoppered funnel. The bisulphide portion was evaporated at 100° C., and gave a residue which weighed 6.258 grms., leaving 2.75 grms. dissolved by the alcohol. This bisulphide residue was a brown greasy solid at ordinary temperatures, and completely liquid at 100° C.

Another alcohol filtrate was taken and evaporated at 100° C., and 10 grms. of the residue taken, as in an ordinary analysis, and treated with carbon disulphide, 60 c.c.; 8 grms. were dissolved containing *all* the anthracen which had been previously dissolved by the alcohol, and leaving 2 grms. of residue which was soluble in alcohol, but insoluble in the carbon disulphide, although an excess had been used.

The bisulphide filtrate from an analysis was then taken and evaporated to dryness, and the residue treated with 200 c.c. of alcohol, as in an actual alcohol analysis. This gave 26.7 per cent insoluble in alcohol, and which had previously been soluble in the carbon disulphide.

We have already mentioned a process of extracting some of the more readily fusible hydrocarbons before treatment with the solvents, by pressure between folds of blotting-paper; and when a solvent method is employed, the bisulphide, for instance, a higher result is obtained by operating upon the material from which some of the oil has been extracted by pressure, than when we operate upon the original crude material.

To illustrate this, the following experiments were made:—

40 grms. of the crude anthracen were pressed between thick folds of blotting-paper, between iron plates in a strong vice for half an hour, when 35.255 grms. of repressed anthracen were obtained, showing—

Expressed oil 11.863
Repressed anthracen .. 88.137
100.000

This repressed anthracen gave 33.12 per cent of residue by the bisulphide method, or 29.19 per cent on the original sample. Before expressing, it gave 27.05 per cent insoluble. Several other experiments are tabulated below:—

Per cent.

	Expressed Oil.	Repressed Anthracen.	Residue before Pressing.	Residue on Repressed Article.	Calculated on Original.
1.	17.156	82.844	28.58	39.60	32.80
2.	20.368	79.632	20.54	30.43	24.28
3.	10.916	89.084	24.12	33.93	30.24
4.	11.350	88.650	26.73	32.75	29.03

These results would promise to be of importance, seeing that in some cases the bisulphide method gives a lower result than the anthracen contained in the sample; and these low results are generally associated with a large percentage of readily fusible and easily expressed oil.

The fusion-points, or rather the mean numbers of the fusion- and solidifying-points, of the alcohol residues, as well as of the bisulphide residues, are always taken as a kind of guarantee of the purity of these residues; but, though a low fusion-point shows the residue to contain a large proportion of a readily fusible hydrocarbon, a high fusion-point is not a sufficient guarantee of its purity. A few illustrations will prove this:—

In one experiment, the residue from a bisulphide determination, that is, the insoluble portion, contained 65.056 per cent of real anthracen, and fused at 208° C.

In another, the bisulphide residue contained 60.0 per cent of anthracen, and fused at 210° C., and it stands to reason that, if we have an excess of high melting hydrocarbons, say, for instance, plenty of chrysen, that the melting-point of this residue will be raised. In some experiments, at one stage of the coking of pitch the bisulphide residue contained only between 1 and 2 per cent of anthracen, yet the fusing-point was 225° C.

As has been shown before, the bisulphide residues fuse at a higher temperature than the alcohol residues; yet analysis does not show so much difference in the amounts of contained anthracen. The fact must be this:—Carbon disulphide dissolves out a greater proportion of the low-melting hydrocarbons, while alcohol seems to have no greater propensity for one than another, and takes a nearly equal share from each.

In taking these temperatures, and in operating generally, perhaps a few remarks will not be out of place. At these temperatures ordinary thermometers may, perhaps, be used for commercial works without introducing any very great error, although it is well known that in many thermometers their indications may be correct at all temperatures from 0° C. to 100° C., but about 200° C. they are often a few degrees out, owing to the increase of the coefficient of expansion of mercury. In delicate matters, no indications should be taken as correct unless the thermometer is compared occasionally with a standard instrument, and that it is able to show distinctly very small variations in temperature.

Furthermore, the bath which holds the thermometer and the trial tube should be large, and not small, as has often been recommended, and the heating very gradual; then the results will come out sharp and accurate, and will bear much criticism. Solid paraffin makes the best bath; it is fluid at the necessary temperature, and does not give off any vapour until heated to at least 176° C., whilst, when sulphuric acid is used, the vapour given off from it is such as prevents any very great attention to the thermometer. We append a few results of the fusing- and solidifying-points of both alcohol and bisulphide residues.

By Alcohol Method.

Indicated Percentage.	Commenced to Fuse. Degrees.	Commenced to Solidify. Degrees.	Mean. Degrees.	Difference. Degrees.
53.90	191	190	190.5	1
48.70	191	188	189.5	3
44.75	188	188	188.0	0
38.30	185	183	184.0	2
41.60	187	186	186.5	1

By Bisulphide Method.

26.55	205	204	204.5	1
26.50	211	208	209.5	3
24.11	210	209	209.5	1
25.11	211	208	209.5	3
22.25	210	208	209.0	2

These bisulphide residues, although they fuse so nearly the temperature of pure anthracen, contain at the most 60.0 per cent of this latter substance; but, as enough has

been written on these empiric methods—methods which depend for their indications upon errors—we will turn our attention to Lück's method of analysis, which gives results based upon the transformation of anthracen into anthrachinon, and gives in nearly every case absolutely accurate results.

(To be continued.)

THE CAUSE OF SOLAR HEAT.*

By DAVID WINSTANLEY.

WHEN a body possessing the visible energy of mechanical translation is arrested in its course, that energy, according to the laws of conservation, is not destroyed, but becomes apparent in another form, generally in the form of heat. Should a body receive two equal impulses in diametrically opposite directions at the same time, mechanical translation as a result thereof is impossible, and the energy thus expended—it appears to be agreed—will in the main assume the form of heat. Should a body, however, receive two equal impulses in directions inclined to each other, mechanical translation will ensue, but the value of the energy of visible motion thus communicated to the body in question is not equal to the sum of the impulses, being, as is well known, justly represented by the diagonal of a parallelogram the length of whose sides is proportional to the value of the primal impulses. What, then, in this case becomes of the residue of energy applied and not converted into visible motion? I apprehend it assumes the form of heat. If so, in the instance of a body receiving equal impulses in directions inclined to each other at an angle of 120° , the resulting visible motion will just account for the energy of one of these impulses, and the resulting heat for the energy of the other. If, then, a body, having a certain amount of visible energy observable as rectilinear movement, have a series of impulses imparted at an angle of 120° , in each instance to the line of motion and equal in value to the visible energy of the body at the time of application, the body in question will gain nothing in visible motion through the application of these impulses, but will simply alter the direction of its movement at each application, and acquire at the same time an amount of heat of which the impulse is the mechanical equivalent. Adopting this view, it matters not at what angle the impulse may be given, for so long as the figure representing its amount yields—with that representing the visible motion of our body—a parallelogram whose resultant is equal to the line of visible motion, it follows that the energy of mechanical translation remains unaltered, and the energy of the impulse becomes wholly transformed into heat. This condition of things, however, is what obtains in the instance of a body in planetary revolution in a circular orbit. It is continually receiving impulses, through the instrumentality of gravitation, at or nearly at right angles to its line of flight, and its energy of visible motion does not increase, whence I infer that the mechanical energy by which its rectilinear movement is destroyed is converted into an equivalent of heat which elevates the temperature of the planet so far as its conditions of radiation will permit. The aggregate value of the impulses required to make a body describe a circle and return to its primal position and direction without loss or gain of visible energy, I have endeavoured to determine graphically by means of the mechanical parallelogram. The result at which I arrive is—that the aggregate in question exceeds the momentum of the body to be deviated in the same proportion as the circumference of a circle exceeds its radius, and this irrespective of the circle's size. I have not attempted to calculate the temperature to which the matter of the earth would be elevated by a sudden stoppage in its orbital path, for it appears to me that satisfactory data for doing this do not

exist. The number of thermal units to which such a stoppage would give rise if multiplied by 6.28 indicate the amount of heat which—upon the present hypothesis—the earth annually receives through the instrumentality of solar gravitation. This amount will, I apprehend, amply account for a certain initial temperature of the terrestrial matter, and for that excess of internal heat which appears to have been pretty well made out. It will be evident that any heat which, in virtue of this hypothesis, may be supposed to fall to the lot of our earth, will, in some calculable proportion, fall to the lot of the other planets also. That proportion I apprehend to be directly as the planet's mass multiplied into its velocity in orbit, and divided by its periodic time. Of course this amount of heat will be distributed over the entire matter of the planet, the temperature of which will depend on the capacity for heat of the matter composing it, and on its facilities for radiation. These latter will clearly diminish with the comparative diminution of superficies enjoyed by the larger planets, and with the extension of their atmospheres. In the case of bodies moving in elliptic orbits, the amount of energy which according to this hypothesis will be transformed to heat in a single revolution will be practically as before, *i.e.*, 6.28 times the planet's visible energy of motion at its mean distance from the sun. There will, however, be this difference between the two cases:—In the instance of a body moving in a circular orbit the accession of heat will be a constant quantity in equal increments of time and in all parts of the orbit, whereas in the case of a body moving in an ellipse the accession will be least in approaching the perihelion and greatest in receding from it, inasmuch as the solar gravitation produces an increase of mechanical translation in the former instance and a diminution in the latter. Assuming the theory to be correct, this circumstance is one which will greatly mitigate the extremes of heat to which—apart from such a consideration—we should expect cometic bodies to be subject. Indeed, in spite of the enormous distances to which they recede from the sun, the voluminous nature of their atmospheres by which radiation must be diminished, may, in conjunction with this view of the case, afford an explanation of the unexpectedly high temperature which, in the case of these bodies, the spectroscope certainly seems to indicate.

The application of the views herein advanced to an explanation of the cause of solar heat is briefly this:—As the mutual and ever-acting gravitation of the sun and his attendant planets produces in the instance of the central luminary no more acceleration of visible motion than in the instance of the planets themselves, the gravitation must result in the exhibition of some other form of energy, which—in the one case as in the other—will, I apprehend, be the form of heat. Carrying, however, this idea to the extreme, we should be led to infer that the force of gravitation, which in some circumstances is certainly capable of transference into the form of mechanical translation, and thence into the form of heat, is in others just as capable of transformation in the opposite order. Indeed, if heat is to be regarded as the individual movement of a multitude of particles whose simultaneous movement is observable as mechanical translation, it is but reasonable to suppose that a force acting upon all, but from the circumstances of the case incapable of producing a simultaneous and concordant movement, will produce an individual—and in a sense discordant—motion of those same particles. Looking at the matter in this way, any agglomeration of particles whatever must have some initial heat as a result of that gravitation which is unable to evince itself as mechanical translation. And as, in our experience, gravity is unceasing, this heat, so far as we can see, should be never ending during the continuance of those conditions which prevent the movement of translation. And a never-ending supply of heat must cause an elevation of temperature which will only cease when a point is reached at which the rapidity of radiation equals the rapidity of supply. The more numerous the

* A Paper read before the Manchester Literary and Philosophical Society.

particles composing the agglomerated body the less become the opportunities of radiation and the more elevated the temperature, which latter attains its maximum in our own system in the instance of the stupendous body which maintains the superficial mundane heat by irradiation from its fires.

It will be seen that the theory here projected places itself in antagonism with the doctrine that "a stone high up" has anything which can be justly termed "the energy of position." But I have already occupied sufficient time without staying now to combat further the doctrine I have named.

To those who have been accustomed to regard gravitation as a property which enables bodies to act where they are not, the present considerations will present difficulties not encountered by others who accept the beautiful—and to my thinking more rational—hypothesis that the simple mechanical movement of infinitesimal particles is the immediate cause of that grand effect, the law of universal gravitation.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 15, 1875.

Professor ABEL, F.R.S., President, in the Chair.

AFTER the minutes of the previous meeting had been read and confirmed and the donations to the Society announced, Messrs. J. M. Thomson, J. G. Gordon, D. Kingsford, E. Sonstadt, and D. Galton were formally admitted Fellows of the Society. The names read for the first time were those of Messrs. G. Bischof, P. Melmore, C. G. Cresswell, T. Wardle, D. Clerk, W. Grant, G. Johnston, and H. Child; Messrs. George Alexander Keyworth, J. Scudamore Sellon, and Richard Cowper were ballotted for and duly elected after their names had been read for the third time.

The first paper, "*On the Gases Enclosed in Coals from the South Wales Basin, and the Gases Evolved by Blowers, and by Boring into the Coal itself*," by J. W. THOMAS, was read by the author. After referring to Meyer's researches on the same subject, the author described the method he employed, which differs from Meyer's. A slip of coal cut from the centre of a block was introduced into a glass tube, which was then exhausted with a Sprengel's pump; but little gas was evolved. The tube containing the coal was now heated to 100° for several hours, and the evolved gases collected; it was found, however, that the whole of the gases enclosed in the coal were not withdrawn at 100° or even 200°. The bituminous coals evolved comparatively little gas, 100 grms. giving only from 55 to 61 c.c. of gas; steam coal gives much more, 147 to 375 c.c. per 100 grms.; and anthracite the most, 555 to 731 c.c. In all cases the gases consist of marsh gas, carbonic anhydride, and nitrogen, but the proportions vary greatly, bituminous coal containing comparatively little marsh gas, whilst steam coal and anthracite contain as much as 87 per cent. The gas evolved from "blowers" in most cases consists almost entirely of marsh gas.

The PRESIDENT, in thanking the author for his interesting paper, said he had no doubt it would elicit discussion as his results differed so greatly from those of Meyer, especially in the proportionally small amount of carbonic acid and nitrogen he had obtained.

Professor V. HARCOURT would like to know what grounds the author had for saying that the gas which was given off when the coal was heated was merely what was contained in the pores of the coal, and was not produced by decomposition. The gas absorbed by porous bodies, like charcoal, when expelled by heat, was again absorbed as it

cooled; this did not seem to be the case with the coal. In some experiments he had made for the purpose of removing sulphur from gas, he had found that when heated in a current of gas such as steam or air, the coal had become extremely porous, although there was no change in its appearance. It now absorbed certain constituents of coal-gas, and when heated gave them up; on cooling they were again absorbed.

The PRESIDENT remarked that Meyer had observed that when coal was heated to a comparatively low temperature, he believed 50°, certain heavy hydrocarbons were obtained, amongst others butylen, whilst Mr. Thomas even at 300° only found carbonic anhydride, nitrogen, and marsh gas.

Mr. MORRIS said he would like to ask, what was the depth of the seam of coal? what its temperature? and what was the nature of the roof?

Mr. THOMAS replied that coal which had been seventy hours in a Sprengel vacuum, when heated, gave off about ten times its volume of gas, and when allowed to cool in it only about half a volume was absorbed. With regard to the depth of the seam, he had found that in the same seam the greater the depth the larger was the percentage of marsh gas in the gases contained in the coal, and also that the total amount of gas was greater.

A paper "*On Narcotine, Cotarnine, and Hydrocotarnine (Part I.)*," by G. H. BECKETT and C. R. A. WRIGHT, was read by the latter. The cotarnine employed in these experiments was prepared from narcotine by the action of dilute sulphuric acid and manganese dioxide, and after the separation of the opianic acid precipitating it by strong soda solution. It may be purified by crystallisation from benzene when it has the composition $C_{12}H_{13}NO_3 \cdot H_2O$. The platinum salt is $(C_{12}H_{13}NO_3 \cdot HCl)_2PtCl_4$. The cotarnine was converted into hydrocotarnine by dissolving it in dilute hydrochloric acid, and treating it with granulated zinc. In order to extract the base a large excess of ammonia was added, and the solution agitated with ether; this takes up the hydrocotarnine, and deposits it on evaporation in fine prisms an inch in length. These crystals have the composition $2(C_{12}H_{15}NO_3 \cdot H_2O)$. It forms a crystalline hydrochloride, $C_{12}H_{15}NO_3 \cdot HCl \cdot H_2O$. Hydrocotarnine is always produced in the preparation of cotarnine from narcotine in the manner above described. The action of manganese dioxide and sulphuric acid on hydrocotarnine converts it into cotarnine, but much tarry matter is formed at the same time; narcotine does not take up hydrogen when treated with reducing agents, and when boiled with baryta water it yields meconin, but no opianic acid; heated with water to 150° it is decomposed, meconin and hydrocotarnine being found amongst the products. From these results it seems probable that in the preparation of cotarnine from narcotine, the latter first splits up into opianic acid and hydrocotarnine thus:—

$C_{22}H_{23}NO_7 + H_2O = C_{10}H_{10}O_5 + C_{12}H_{15}NO_3$,
and that the hydrocotarnine is then oxidised to cotarnine.

The physiological action of cotarnine and hydrocotarnine has been examined by Dr. F. Pierce who finds that whilst the former, in doses up to 0.5 grm., does not produce the slightest effect, hydrocotarnine produces severe epileptiform convulsions, great muscular prostration, and salivation.

Dr. ARMSTRONG said he was greatly interested in these results, as he had worked from time to time on the same subject. From the experiments of Matthiessen, Foster, and Wright, there was no doubt as to the formula of opianic acid. It partook of the nature both of an aldehyde and of an acid, $C_6H_2(OCH_3)_2 \cdot COH \cdot COOH$. By treatment with hydriodic acid it yielded methyl iodide, and when sulphurous anhydride was passed into its aqueous solution, and barium hydrate added, a compound of barium opianate and barium sulphite was obtained similar to that formed with aldehyde. Hemipinic acid was undoubtedly the dibasic acid, $C_6H_2(OCH_3)_2(COOH)_2$, corresponding to the monobasic opianic acid. With respect to meconin its

constitution was not so well made out, but it might be regarded as a kind of lactid. The action of nascent hydrogen on opianic acid first producing a compound $C_6H_2(OCH_3)_2(CH_2OH)(COOH)$, which being unstable lost water and gave meconin, $C_6H_2(OCH_3)_2CH_2.O.CO$.

Dr. WRIGHT replied that he agreed perfectly with Dr. Armstrong; he had for some years past adopted the formulæ given, and believed them to be correct. Great interest would attach to the isolation of opianic acid, &c., from some other of the opium alkaloids, but although he had made many attempts, he had not yet been successful.

Mr. D. HOWARD said the last remark of Dr. Wright touched on a point of great importance. Might it not be said of many of these substances obtained from opium, are they in opium? or to go farther, are they in the poppy juice? As to how far these changes might take place in the system it would be very inconvenient if, when an anodyne was prescribed, it should be found to become so changed as to produce epileptiform convulsions.

The PRESIDENT having thanked the authors in the name of the Society,

Dr. ARMSTRONG read a "Note on Isomeric Change in the Phenol Series." On heating β dinitro-phenol with

bromine and water, bromo-dinitro-phenol melting at 116° was obtained identical with that produced by the action of bromine under similar circumstances, on α dinitro-phenol. When β dinitro-phenol is gently heated with bromine and glacial acetic acid, Körner's bromo-dinitro-phenol melting at 75.6° is the sole product, but if the mixture be boiled, a bromo-dinitro-phenol melting at 116° is formed. It appeared, therefore, that the one compound was converted into the other by the action of bromine, or of heat, or by the combined action of both. On trial it was found that the compound melting at 75.6° underwent no change when heated alone to 120° , but with bromine and water at 100° it was entirely converted into the isomeric body of higher melting-point. The action of bromine and water on the dibrom-ortho-nitro-phenol melting at 117° , or on dibromo-para-nitro-phenol melting at 141° yielded a substance insoluble in alkaline solutions and melting above 200° . In a similar manner the action of fuming sulphuric acid and of sulphuric chlorhydrate on dichloro-phenol yielded sulphonc acids which were isomeric and not identical, as the former on nitration gave Stenhouse's chloro- α -dinitro-phenol, whilst the latter yielded dichlor-ortho-nitro-phenol.

The PRESIDENT thanked Dr. Armstrong for his interesting paper, and then adjourned the meeting until Thursday, May 6, for which the following communications are announced:—(1) "On Andrewsrite and Chalkosiderite," by Professor N. Story Maskelyne; (2) "Quantitative Separation of Iron Sesquioxide, Alumina, and Phosphoric Acid," by Dr. W. Flight; (3) "On Sodium Ethylthiosulphate," by Mr. W. Ramsey; (4) "On a Milligrade Thermometric Scale," by Mr. J. Williams.

Pure Dextrin from Malt.—M. L. Bondonneau.—The author describes the properties of dextrin as formed by the action of diastase. The sample gave no colouration with iodine; with cupric liquid it shows 1.85 per cent of glucose; it is reduced by chloride of gold and ammoniacal nitrate of silver; with baryta water and ammoniacal acetate of lead it gives an abundant precipitate, and is not precipitated by subacetate of lead. The rotatory power of this substance is $\alpha_D = 176^\circ$ to the right; that of the pure dextrin obtained by the action of heat is $\alpha_D = 186.3^\circ$ to the right.—*Bull. de la Soc. Chim. de Paris.*

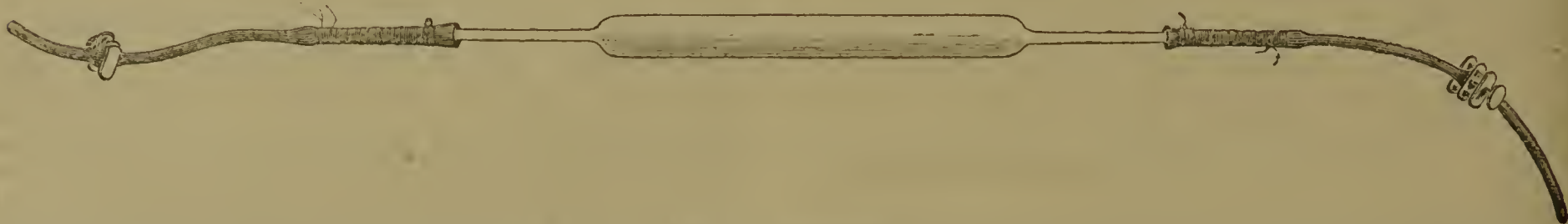
SOCIETY OF PUBLIC ANALYSTS.

NOTE ON TWO NEW FORMS OF TUBES FOR COLLECTING AIR FOR ANALYSIS.

By G. W. WIGNER.

I HAVE had occasion, during the last two years, to make some hundreds of analyses of atmospheric air from factories and other places, and of the gaseous contents of white-lead stacks. The samples have frequently been collected under circumstances which rendered the sealing of glass tubes in the ordinary way peculiarly difficult, and I have therefore adopted two new forms of collecting tubes, which are extremely easy to manipulate. The analyses have all been made by the *McLeod* apparatus, or by a modification of it which I propose to describe at a future time, and the tubes are adapted to facilitate the transfer of the air to the measuring tube of that apparatus.

The first form of tube is that which I use for technical purposes. It consists, as shown in sketch, of a glass tube about 12 inches long over all, in the centre of which a cylindrical bulb has been blown, about 6 inches long and



$\frac{3}{4}$ inch diameter. The tube at the ends has an internal bore of about $\frac{1}{16}$ inch, the total capacity being between 40 and 50 c.c.

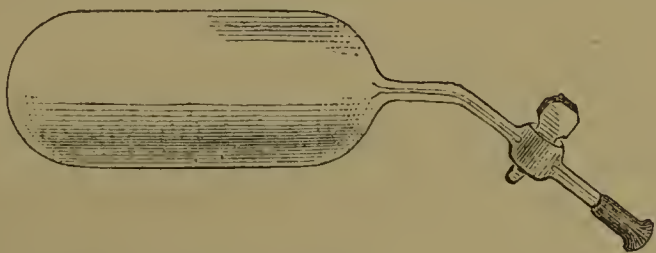
On each end of the glass tube a piece of india-rubber tube, about 6 inches long, is securely tied, the glass tube being thoroughly waxed first to ensure a perfect joint. The india-rubber tube used is about $\frac{1}{4}$ inch bore, and of the best quality procurable, having been made specially for the purpose. On each piece of india-rubber is a Bunsen screw-clamp. I generally fill the tubes by drawing the air into them by means of a small pocket pair of bellows having a tube connected to the suction valve, which is joined by a short length of tubing to the sample tube. After drawing air through to the extent of say thirty times the capacity of the tube, the clamps are closed.

I prepare the sample for transfer to the measuring tube of the *McLeod* apparatus as follows:—Into each of the free ends of the india-rubber tubes I pass a piece of glass tube, about $\frac{1}{4}$ inch external diameter, with a capillary bore. These tubes are filed to a wedge form (not sharp) at the end which is passed in, and are pushed *close up* to the clamps, and then tied with copper wire. If these precautions are taken it will be found that the amount of atmospheric air contained between the pinchcock and the capillary tube, and in the capillary tube itself, will be only a minute fraction (less than 0.02) of a c.c., and even this may be removed and replaced by water if two or three drops are poured into the india-rubber before the glass tube is inserted. One of these capillary tubes is furnished at the outer end with a steel facet, corresponding to the facet on the measuring tube of the gas apparatus. The transfer of the air is then readily effected. The sample tube is placed in a slightly inclined position on the table-stand of the gas apparatus, the facet clamped up to the measuring tube, the other capillary tube immersed in a trough of mercury, and a vacuum produced by lowering the mercury in the measuring tube. It is only necessary to unscrew the clamps and open the stopcock of the measuring tube, and all the air except a small bubble will be transferred. In practice this transference can be easily effected in less than five minutes.

Some doubt was felt at first as to whether the india-rubber tubes would be impervious to the gas, but experi-

ments on various artificial mixtures, resembling very polluted atmospheric air, have proved that for periods not exceeding three or four days no appreciable change can be detected.

The other form of collecting tube is as follows:—



It consists of a strong cylindrical flask, about 4 inches long and $1\frac{1}{2}$ inches diameter, with a slightly curved capillary tube as a neck at one end. This capillary tube is fitted with a glass stopcock, and at the end with one of the same steel facets. Its total contents are about 90 or 100 c.c.

For use the air is exhausted from this tube, and the stopcock opened for a few seconds in the place from which the sample has to be taken. The transfer of part of the contents to the McLeod apparatus is of course easily effected, but it is not possible to take all the air unless the Sprengel pump is used for the purpose. I find that I can practically transfer with ease about 70 c.c., which is usually sufficient.

The vacuum may be readily produced in two ways.

If the Sprengel pump is in use it will, of course, do it efficiently, but slowly. I prefer, however, the following plan:—I clamp the facet on to a good Tait's air-pump, and exhaust; then unclamp, and immerse the facet in the mercury trough, allowing the mercury to rise into the tube. Of course only a small bubble of air will be left, and, by repeating the exhaustion two or three times, this may be reduced to microscopical dimensions. The tube is then emptied of mercury as follows:—In the table of the McLeod apparatus I have a mercury trough, $\frac{1}{2}$ inch diameter and 3 feet deep. It consists simply of a piece of $\frac{1}{2}$ -inch gas-pipe, with a plug at the bottom and a flange at the top, the latter being screwed to the table. A glass tube, of small bore, 3 feet long, and furnished with a stopcock near its upper end, is immersed in this trough, and filled with mercury, so as to form a small barometer tube. A facet at the top of this tube is clamped to the facet of the (mercury filled) collecting tube, and on opening the stopcocks the collecting tube becomes part of the barometer, and the torricellian vacuum is formed in it.

I have not yet met with any foreign stopcocks good enough for such work, but Cetti's stand well. I have tested some selected stopcocks of his make by the torricellian vacuum for three weeks, and been unable to detect any passage of air. The tubes which I have described have also been made by him.

AFTER repeated postponements, the "Sale of Food and Drugs" Bill was partially considered in Committee of the House of Commons on Monday night. Though the number of amendments of which notice had been given was very large, the actual progress made with the Bill was not great.

The first amendment proposed, and which was accepted by the House, was in Clause 2.

As our readers are aware this Bill is "to repeal the Adulteration of Food Acts, and to make better provision for the Sale of Food and Drugs in a pure state."

Its first necessity is, therefore, to define what is to be considered "Food," and what "Drugs." According to the Bill as it stood, "the term *food* shall include every article "used for food or drink by man, other than drugs." It will be seen, by a consideration of this definition, that

it might have been so stretched as to include *water*, which has hitherto been considered; and which should be considered as outside any adulteration Act, not being a purchasable commodity in the same sense as other articles of food and drink. Mr. Spencer-Stanhope proposed that the words "or water" should be inserted after the word "drugs," thus making it clear that "food" should not be considered to include either "drugs" or "water." We thank the hon. member for the West Riding for this very sensible amendment, which, as we have said, the House adopted, as it appears to us only proper that all analyses of water should be paid for as private samples, as they hitherto have been.

When, however, we come to learn the reason which the hon. member gives for proposing his amendment, we are struck with mingled feelings of amazement and amusement. It is "in order to make it clear that water may be analysed under this Act." We should be inclined to doubt the correctness of the report in the *Times*, but that the extraordinary reason given accords exactly with a speech made by Mr. Stanhope (we believe at a meeting of the Farmers' Club) a short time ago.

The hon. member will probably be surprised to learn that the effect of his very excellent amendment will be the exact reverse of what he expected. In Clause 3, two amendments occur. The first is the excision of the word "knowingly" from the first line, the effect of which will be that any person who shall "mix, colour, stain, or powder, any article of food with any ingredient of a nature injurious to health," shall be held, as a matter of course, to have done it knowingly, and be punished accordingly. The other amendment is to substitute for a fixed penalty of £50 for the first offence of knowingly selling an article so "mixed," "coloured," "stained," or "powdered," a fine "not exceeding" £50, thus giving the magistrates power to mitigate the penalty.

Sir Andrew Lusk is the author of this amendment, and there may be good reasons for allowing magistrates a certain amount of discretion, though its result in the working of the present Act has been that (the magisterial mind being variable) a man has been fined as many pounds in one district as he has been shillings in another for precisely the same offence.

Sir Henry Peek supported this amendment on the curious ground that a man might kick his wife to death for less than £50, and therefore argued, we presume, that it was manifestly unfair that he should be mulct in a similar amount for only cheating and half poisoning his neighbour. If Sir Henry Peek considers that a fine of £50 is an adequate punishment for killing a man's wife, he is quite consistent in thinking the amount too heavy for the offence of adulteration; but it certainly is news to us that the crime he mentions can be expiated by the payment of any such sum. In fact, we were simple enough to imagine that, if a man killed his wife, he was guilty either of manslaughter or murder, but we must of course bow to the high authority of Sir Henry Peek, corroborated as it is by the "experience" of Sir Andrew Lusk.

In Clause 4, which forbids the adulteration of drugs with any ingredient *of a nature injurious to health*, the words we have printed in italics are struck out, and in their place, at the suggestion of the President of the Local Government Board, are inserted the words, "so as to injuriously affect the quality or potency of the drug."

This we consider a most decided and marked improvement.

Clause 5, it will be remembered, is qualified by certain "exceptions," one of which is that "any harmless matter may be mixed with an article, for the purpose of rendering it portable, or palatable, or of preserving it, or of improving its appearance;" but to avoid the abuse of this "exception," the words are now added, "unless such matter is used to conceal the inferior quality of the article." For this "amendment," which is also an improvement, we are indebted to Lord Frederick Cavendish.

It will be seen from the foregoing short review that, of the 33 clauses of the Bill, only the first five have yet undergone manipulation in Committee.

NOTICES OF BOOKS.

Consumption and Tuberculosis; Their Proximate Cause and Specific Treatment by the Hypophosphites. By JOHN FRANCIS CHURCHILL, M.D. London: Longmans, Green, and Co.

As a general rule systems of medical practice can scarcely be deemed to come within our sphere. The author of this work proceeds, however, upon an unusual principle. Instead of, in the ordinary manner, taking in hand some substance whose therapeutic properties happen to be unknown and trying at hap-hazard what it may accomplish in the treatment of different diseases, he endeavours to ascertain by careful research what is the essential feature of tubercular degeneration. Finding evidence that it was due to a "diminution of the phosphorus element in the system," he sought next what compound of phosphorus was best calculated to supply the deficiency, and decided in favour of the hypophosphites. Having thus a theory, he proceeded in due course to the next step, experimental verification. All this we must pronounce to be a strictly logical and legitimate procedure. But what were the results of the verification? Dr. Churchill does not profess that every patient was cured. In some the disease was already so far advanced that recovery was impossible; in others the carelessness of the patient, his manner of life, or the presence of special complications led to a negative result. But in a most decided majority of cases within reasonable limits, the theory proved triumphant, and the patients recovered. Corresponding success has attended this method of treatment in the hands of other physicians, when the conditions laid down by the discoverer were observed, especially when the remedy was genuine, free from phosphites, phosphates, carbonates, &c., and unaccompanied by other medicines which frustrate or modify its action. We learn that sometimes the hyposulphites have actually been sold and used as hypophosphites!

The reception of so important a discovery has not been encouraging. The hypophosphites have been used not according to Dr. Churchill's suggestions, and he has then been blamed for the resulting failures. In other quarters his remedies have been used in secret, and the cures have been attributed to other causes. Conduct of this kind we must admit is not exclusively confined to the medical profession. We have heard of an influential chemist who publicly condemns a certain analytical process, and uses it in private in preference to his own rival method.

The following passage is but too true:—"That in this age of sanitary professors and sanitary humbugs this cause of disease (increased sensitiveness and activity of the nervous system) will attract the attention of those who govern it would be childish to expect or hope. If the means of prevention involved some enormous outlay, requiring some stupendous engineering enterprise, and thus opened a field for some enormous contract . . . no doubt they would attend to it. Perhaps some Government official may be bold enough some centuries hence to try the effect of the hypophosphites in promoting the growth and development of military recruits."

Elsewhere we read:—"This is the last ordeal of the inventor before his apotheosis. Among artisans, it is called 'rattening'; in science, it constitutes the well-known process which the French call 'the Conspiracy of Silence.'" What inventor or discoverer cannot confirm this from his own experience? The passages on the treatment of inventors and on the rights of intellectual property deserve to be carefully studied in these days when lawyers and capitalists, eager to protect every other

kind of property, are conspiring to rob the patentee and the discoverer.

We hope that all who are interested in Patent Law Reform will read pp. 406—418 of this work, and reflect thereon. It may supply an antidote to the views of Lord Romilly, the Lord Chancellor, and the "Free-stealing" party.

On a Peculiar Fog seen in Iceland, and on Vesicular Vapours. By R. ANGUS SMITH, Ph.D., F.R.S., &c. London: Taylor and Walton.

IN this pamphlet, which is reprinted from the fifth volume of the third series of "Memoirs of the Literary and Philosophical Society of Manchester" (Session 1872, 1873), the author gives an account of a remarkable fog observed at Reikjavik, in Iceland. It appears that, on a bright afternoon in July, "as soon as we left the house, a cloud came down a street from southwards, and some one said, 'let us cross out of the way of the dust.' 'I looked more carefully, and finding the cloud moving very slowly on the ground, concluded that it was smoke from a chimney, but smoke mixed with larger particles than we generally see. Gradually it came to us; there was no smell, but a distinct chill.' Perceiving that it was a fog, Dr. Smith ascended a rising ground, and saw the fog rising out of the small lake behind the town, and rolling into the streets very slowly. A similar fog rose from the sea, and rolled also into the town. Hence it appeared that the wind had nothing to do with the matter, but that both fogs rolled because they were too heavy to remain suspended. The peculiarity of the fog was in the size of its particles, larger than any the author had ever before seen, and which he estimates at from $\frac{1}{400}$ th to $\frac{1}{300}$ th of an inch in diameter, in the flatness with which it fell on the ground, and in its lumbering mode of rolling, whence all observers at first took it for dust. The author found that the particles were perfectly spherical, and not hollow, but concrete throughout. "They all tended downwards they were falling evidently; it was a falling dew, or a slight incipient rain rapidly disappearing into the earth." Dr. Smith adds: "It seemed evident to me that to make a distinction absolute between fog, rain, and dew, was a waste of words. There is a broad observable distinction, but no narrow line, and we cannot tell the end or beginning of either."

Examining the common opinion of the vesicular nature of clouds and mists, he declares that it "rests on a foundation too weak to be worth much attention. He gives the opinions of some who may be regarded as the best known originators of the vesicular theory, such as Edmund Halley (*Phil. Trans.*, abridged, vol. iii., p. 428). Gottlieb Kratzenstein ("Theorie de l'Elevation des Vapeurs, Bourdeaux, 1743), M. Hamberger, who wrote in the same year, and H. B. de Saussure ("Essais sur l'Hygrometrie," p. 282). None of these meteorologists give any decisive experiments or observations in support of the vesicular theory, but "only a few fancies by no means well supported, even in the opinion of the authors, and still less in that of natural philosophers at the present time." A vague notion that the globules of fog are analogous to soap-bubbles seems to lie at the foundation. Dr. Smith has repeated the experiments of Saussure, but without meeting with any signs of vesicularity. "Indeed," he remarks, in summing up, "I see no reason for going far for a mode of keeping clouds up. Times without number I have observed on calm summer evenings a cloud of smoke from a steamboat funnel lying for miles in length at a height very little different from that of the funnel out of which it issued. . . . At other times I have found the smell of a cigar, used by a person fully a quarter of a mile on, over the road, at about the same height as his mouth, nothing being visible. In these cases, have we anything to look to but the size of the particles? They are so small that their resistance to the atmosphere is diminished to its utmost, as the resist-

ance of the air is increased so much in proportion to the weight, that they cannot fall rapidly."

Eighth Annual Report of the Warden of the Standards on the Proceedings and Business of the Standards, Weights, and Measures Department of the Board of Trade for 1873-74.

THIS report contains much valuable information, of a nature calculated to interest the commercial as well as the scientific world.

From it we learn that the plan of coating weights with nickel, in order to exclude the action of the atmosphere, cannot be pronounced successful. Three of the larger weights, nickelised in 1872, were found in June, 1874, to have sensibly increased in weight, "tending to show that oxidation is going on under the nickel plating."

It is unsatisfactory to find that "the teaching of the metric system of weights and measures, and the decimal scale in schools, under the authority of the Education Department, "has been formally abandoned by virtue of a notice in the "New Code of Regulations of the Education Department of the Privy Council, issued in 1874." This reactionary step will decidedly retard the much needed reform of our national weights and measures. An attempt made by the Swedish Government to introduce the metric system of weights and measures into the kingdom of Sweden, has been defeated in the Lower Chamber of the Diet by a very large majority.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 11, March 22, 1875.

Examination of the Procedures of the Human Mind in the Investigation of the Unknown by the Aid of Observation and Experiment.—M. Chevreul.—Not adapted for abstraction.

Stability of the Salts of the Fatty Acids in Presence of Water, and on the Reciprocal Displacement of these Acids.—M. Berthelot.—The author finds that the alkaline salts of the fatty acids, in presence of water, behave like compounds intermediate between the salts of the strong acids, which are not appreciably decomposed by water, and the salts of the weak acids (carbonates, borates, &c.), which are partially decomposed by water in the ratio of its quantity, and with a tendency to the simultaneous formation of an acid salt and of free base. This analogy between the fatty acids and the weak acids becomes more striking as their equivalents rise; from formic acid, which is almost as energetic as the powerful mineral acids, to the valerianic, whose neutral salts easily become acid by evaporation; and to the stearic and margaric, whose alkaline salts (soaps) are so readily decomposed by cold water.

Association in the Ural of Native Platinum with Rocks having a Basis of Peridote, and the Relation of Origin which unites this Metal with Chrome Iron.—M. Daubrée.—It is very probable that serpentine was the gangue in which platinum was originally disseminated, at least in the country of Nisché-Tagilsk.

New Electro-Medical Galvanoscope.—M. J. Morin.—The author states that in the therapeutical application of continuous currents the use of the common galvanometer has the inconvenience of requiring preliminary regulation, which requires care and experience on the part of the operator. His new electro-medical instrument is free from this defect.

Theory of Processes for Magnetisation.—M. J. M. Gaugain.—Not suited for abstraction.

Molecular Equilibrium of Solutions of Chrome Alum.—M. Lecoq de Boisbaudran.—A mathematical paper, which requires the accompanying diagram.

Determination of the Boiling-Points of the Chlorinised Derivatives of Toluene.—M. G. Hinrichs.—The same remark applies to this paper.

Bulletin de la Societe Chimique de Paris,
No. 3, February 5, 1875.

Saccharo-Carbonate of Lime and Hydrated Carbonate of Lime.—M. L. Bondonneau.—It has been observed long ago that solutions of sucrose of saccharate of lime, treated with carbonate of lime, do not deposit carbonate of lime, but that at a certain point the liquid thickens, and is converted into an opaline mass, decomposable into its elements by excess of carbonic acid and by heat. The mass thus formed has been viewed as a combination of saccharate and of carbonate of lime. The author remarked that the quantity of carbonic acid absorbed to form this magma varied according to the density in solutions of one and the same saccharate. He was hence led to the belief that sugar merely entered into the reaction by means of the increase of density which it occasioned, and that similar thickenings might be obtained with other aqueous solutions; which experience has confirmed in case of gum, dextrin, glycerin, and even of mineral solutions, such as nitrate of soda and chloride of sodium. The thickening is due, not to saccharo-carbonate of lime, but to hydrated gelatinous carbonate of lime.

Cement for Marble and Alabaster.—Mix 12 parts of Portland cement, 6 parts of slaked lime, 6 parts of fine sand, and 1 part of infusorial earth, and make up into a thick paste with silicate of soda. The object to be cemented does not require to be heated. It sets in twenty-four hours, and the fracture cannot be readily found.

Certain New Bleaching Processes.—M. A. Brackebusch.—The methods generally used are not satisfactory, and hence attempts are being made to supersede them. (1) Cotton and linen tissues are brought in contact with oxide of zinc, dissolved in lye of potash or soda. There is no bleaching, properly so-called. The oxide of zinc combining with the textile fibre merely masks the natural colour of the latter. Possibly it may form colourless compounds with the colouring matters present. The alkaline liquids employed may affect the tissues. (2) It has been proposed to bleach wool and silk by immersion for an hour in a solution of 1 part common salt, and 1 part of oxalic acid in 50 of water. The influence of the oxalic acid is certain, though not explained. (3) Tessiédu Motay takes about equal parts of permanganate of soda and of sulphate of magnesia, and dissolves them in luke-warm water. The tissues, previously freed from grease, are plunged into this bath till they are covered with a brown coating. They are then placed in a bath of sulphuric acid at 4 per cent, and rinsed after the brown matter is removed. They may be finally passed through sulphurous acid. (4) Ramsay forms his bleaching bath by sprinkling with water equal parts chloride of lime and sulphate of magnesia, when hypochlorite of magnesia is formed. This last process is highly recommendable.

Use of Red Sanders.—Sanders-wood, despite its cheapness, is not much used in dyeing. The red matter is accompanied by a brown colour, which must be completely eliminated—a process not unattended with difficulty. The principles found in sanders are—(1) A bitter, brown extractive matter, sparingly soluble in cold water, but readily soluble at a boil. (2) A red matter, santalin; insoluble in water, soluble in alcohol, strong boiling acetic acid, caustic alkalies, and hot alkaline carbonates. It undergoes a change if exposed to the air in a moist state, and is oxidised, especially in presence of alkalies. (3) Santalidin, one of the oxidation-products of santalin, is less insoluble in water than santalin, but dissolves more freely in the other solvents. The powdered wood, exhausted in boiling water to remove the brown matter, is

digested in a cold clear solution of chloride of lime as long as this becomes coloured. When this is done, it is carefully washed in cold water, and the dye-bath is prepared. A hot, but not boiling, solution of carbonate of soda is prepared, into which is put the wood contained in a linen bag, and the pan is tightly covered. Heat is applied without bringing it to a boil. When the bath has acquired a bright red colour with a violet tint, it is ready for use. The goods (woollen, cotton, or linen), mordanted in an acid bath, are plunged into the sanders beck till they have the wished for shade, and are then returned to the acid beck. Shades are thus obtained not inferior to madder work in brightness and solidity.—*Muster Zeitung*.

[We copied this process from the notebook of a friend sixteen years ago, and are therefore much interested to find that it has been re-discovered.]

Liebig's Annalen der Chemie und Pharmacie.
Band 177, Heft 1, Feb. 27, 1875.

Researches from the Laboratory of Prof. F. Beilstein, of Petersburg.—These researches comprise a paper on sulpho-butyric acids, by W. Hemilian; one on the bromine derivatives of ethan, by N. Tawildarow; and a note on the connection of substituted benzols and phenols, by F. Beilstein and A. Kurbatow.

Chlorinised Xylidin obtained from Crystalline Xylol.—Paul Jannasch.—The chlorinised xylidin (para-amido-xylol) is a crystalline base, fusible at 92° to 93°, of faint unpleasant odour, resembling that of toluydin. It is extremely soluble in ether, alcohol, and benzol; scarcely soluble in cold, but moderately so in boiling water, from which it separates in fine foliaceous crystals. It evaporates readily along with watery vapour, and when heated in a hot current of steam it fuses to dull yellow drops. It combines with acids, forming a well-characterised and finely crystalline series of salts, which, however, in consequence of its feeble basic properties, are not very permanent.

Communications from the Laboratory of the University of Erlangen.—Prof. von Gorup Besanez.—These comprise a paper on ratanhia, by Dr. B. Kreitmair; on peucedanin and its products of decomposition, by Dr. Gottlieb Heut, containing an account of the preparation and properties of peucedanin, and its behaviour with potash, with dilute sulphuric acid, with the halogens, and with nitric acid, and an account of oxy-peucedanin; further, a paper on the occurrence of thallium in carnallit, by Dr. F. Hammerbacher. From this it appears that Boettger had already demonstrated the presence of cæsium, rubidium, and thallium in the salts of the Nauheim brine springs. The author, therefore, examined carnallit and other Stassfurt salts containing potash in the same manner. In carnallit he found thallium, rubidium, and cæsium; in sylvin the two latter were recognised, but no thallium; polyhalit and kainit showed no traces of either thallium, rubidium, or cæsium. The Erlangen researches further contain a paper by R. Hornberger, C. Mutschler, and F. Hammerbacher on the ash of the fruits of *Lithospermum officinale*, and the wood of *Calamus rotang* and *Bambusa arundinacea*; and a notice by Prof. von Gorup-Besanez on ditain, a substitute for quinine, recently introduced into commerce, and obtained from *Echitis scolaris*.

Behaviour of the Solutions of Certain Substances with Polarised Light.—O. Hesse.—A long and important paper; not capable of useful abstraction.

Methyl-Aldehyd, and Formic Acid Methylester.—J. Volhard.—The author obtains the former by means of a Davy's lamp fed with methylic alcohol, and the latter by distilling over formiate of lime wood spirit, saturated with hydrochloric acid. The same compound is obtained by decomposing hydrocyanic acid with hydrochlorated wood-spirit.

Determination of the Carbonic Acid in Carbonates.—Julius Hessert.—Persoz proposed to decompose the

carbonates by fusion with bichromate of potash, to dry the evolved gas over chloride of calcium, and to receive it in a weighed potash apparatus. The author has examined this process, and finds that, in comparison with Kolbe's process (*Annalen*, 119, p. 129), it has the disadvantages of being more limited in its applicability, and of requiring a distinct portion of material, but that it has, on the other hand, the advantage of greater simplicity.

Les Mondes, Revue Hebdomadaire des Sciences.
No. 9, March 4, 1875.

In noticing the death of Sir C. Lyell, M. Moigno remarks, "We have found, to our happiness, that in the last edition of this work ("The Antiquity of Man") the arguments which he had previously developed in favour of the indefinite antiquity of man have lost much of their value!"

Determination of Glycerin and Succinic Acid in Wines.—M. Maumené.—The author holds that the quantity of these bodies, as produced by the fermentation of glucose simultaneously with alcohol, will be proportionate to the latter, and that the exact knowledge of their amount may thus indicate the quantity of extraneous alcohol added to wine. He prepares hydrated oxide of lead by decomposing a soluble salt of that metal with potash, and after washing it well, suspends it in water. To half a litre of wine, concentrated by evaporation to 335 c.c., he adds oxide of lead enough to cause every trace of colour to disappear. A grey precipitate is formed. Filter, wash the precipitate, and evaporate to dryness in the water-bath. Treat the evaporated residue with absolute alcohol, holding a little hydrated oxide of lead in suspension. Stir, leave the mixture to stand for some hours, and filter. The liquid thus obtained is colourless. If submitted to a current of carbonic acid it grows turbid, but becomes clear again on filtration. It is dried at 110° C., and weighed as pure glycerin. To determine succinic acid, treat a litre of wine with albumen, or raw hide, in sufficient quantity to remove all the tannin. Mix with hydrated oxide of lead (after concentration) till the colour is entirely removed, and preserve the filtrate for the determination of glycerin. The precipitate is kept for a long time in contact with boiling water, containing about 10 per cent of nitrate of ammonia. The clear liquid, obtained on fresh filtration, contains all the succinic acid in the state of succinate of lead, besides other salts of the same base. It is treated with sulphuric (sulphurous?) acid, and filtered again, when we have a perfectly colourless liquid containing free succinic acid. After having heated to expel the excess of sulphuric (sulphurous?) acid, the liquid is concentrated to about 100 c.c., and neutralised with ammonia. Heat sufficiently to expel any excess of ammonia, and add a few drops of ferric chloride, which has been previously kept for a long time in contact with sesquioxide of iron, so as to ensure the absence of free hydrochloric acid. Finally, collect the deposit of succinate of iron which forms, wash it well, ignite, and weigh the residual sesquioxide. This weight, $\times 1.978$, gives the quantity of succinic acid existing in the quantity of wine analysed.

MISCELLANEOUS.

Lectures by Dr. Frankland.—Six lectures by Professor Frankland, on "How to Teach Chemistry," originally delivered to science teachers, will shortly be published by Messrs. Churchill, from notes taken and edited, with Dr. Frankland's sanction, by Mr. George Chaloner, F.C.S.

Metropolitan Gas.—Dr. Le heby, the Chief Gas Examiner under the Board of Trade, has recently reported to the Corporation of the City of London, and to the Metropolitan Board of Works, the results of the daily testings of the gas supplied to London by the Chartered, the Imperial, and the South Metropolitan Gas Companies during the quarter which ended on the 31st of March last.

At present there are nine testing places where the gas from the several works of these companies are daily tested by the officers appointed by the Corporation and the Metropolitan Board of Works, and the average results of the testings during the quarter have been as follows:—(1) *With respect to Illuminating Power.*—The common gas, when burnt at the rate of 5 cubic feet an hour from a Sugg's London argand burner, No. 1, with a 6-inch chimney, has, in the case of the Chartered Company, averaged the light of 17·37 standard sperm candles at Beckton, 16·86 candles at Friendly Place, Bow, and 16·92 candles at Ladbroke Grove, Notting Hill; while that of the Imperial Company has been equal to 16·17 candles at Carlyle Square, Chelsea, 16·04 candles at Camden Street, Camden Town, 16·93 candles at Graham Road, Dalston, and 16·22 candles at Bruce Terrace, Bromley. The gas of the South Metropolitan Company at Hill Street, Peckham, has been 15·94 standard sperm candles; and the cannel gas of the Chartered Company at Millbank Street, Westminster, has, with a Sugg's steatite bats'-wing burner, No. 7, burning at the rate of 5 feet an hour, given the light of 20·94 standard sperm candles. These results show that the illuminating power of the gas at each of the testing places has been fully equal to the requirements of the Acts of Parliament by which the companies are regulated. (2) *As regards Purity.*—The gas of all the companies has been constantly free from sulphuretted hydrogen, and the average amounts of sulphur in other form than this have been as follows:—In the Chartered gas—At Beckton, 10·97 grains per 100 cubic feet of gas; at Friendly Place, 13·18 grains; at Ladbroke Grove, 19·40 grains; at Millbank, 17·63 grains. In the gas of the Imperial Company, the proportions of sulphur have been 17·49 grains per 100 feet at Carlyle Square, 15·10 grains at Camden Street, 16·18 at Graham Road, and 10·89 grains at Bruce Terrace; while that of the South Metropolitan Company has been 18·33 grains per 100 feet. Dr. Letheby reports that the proportion of sulphur in the gas has exceeded the prescribed quantity on four occasions at Ladbroke Grove, on four occasions at Bruce Terrace, and on three occasions at Hill Street, Peckham. The excess at Bruce Terrace is reported to have resulted from accidental and unavoidable causes. Ammonia has been at all times absent from the gas of the Imperial Company at Bruce Terrace, Bromley; and the maximum amount in the same Company's gas at Graham Road, Dalston, was only 2·10ths of a grain per 100 cubic feet. At Carlyle Square it was 0·7 of a grain, and at Camden Street 1·5 grains. In the Chartered Company's gas, the maximum amount at Ladbroke Grove was only 0·4 of a grain per 100 feet; at Millbank, 0·5 of a grain; at Friendly Place, 2 grains; and at Beckton, 3·8 grains. On two occasions, the ammonia in the gas at the last-named testing place exceeded the prescribed quantity of 2·5 grains per 100 cubic feet. The maximum amount of ammonia in the gas of the South Metropolitan Company was 1·6 grains per 100 feet.

MEETINGS FOR THE WEEK.

MONDAY, 26th.—Medical, 8
— London Institution, 8.
— Geographical, 8.30.
— Birkbeck Scientific Society, 8. Mr. R. G. Madden, "On the Chemistry of Dyeing."
TUESDAY 27th.—Civil Engineers, 8.
— Anthropological, 8.
— Royal Institution, 3. Prof. Duncan, "On the Grandeur Phenomena of Physical Geography."
WEDNESDAY, 28th.—Society of Arts, 8.
— Geological, 8.
— London Institution, 12. (Anniversary.)
THURSDAY, 29th.—Royal Institution, 3. Prof. Seeley, "On the Fossil Forms of Flying Animals."
— Royal Society Club, 6.30.
— Royal, 8.30.
— Zoological, 1. Anniversary.
FRIDAY, 30th.—Royal Institution, Weekly Evening Meeting, 8.
— Mr. W. N. Hartley, "Action of Heat upon Coloured Liquids," 9.
SATURDAY May 1st.—Royal Institution, 2. Annual Meeting.

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THE CHEMICAL NEWS.

VOL. XXXI. No. 805.

ON ATTRACTION AND REPULSION RESULTING FROM RADIATION.*

By WILLIAM CROOKES, F.R.S., &c.

PART II.

THIS is the second part of a paper which the author sent to the Royal Society in August, 1873. The author commences by describing improvements which he has made in the Sprengel pump, and in various accessories which are necessary when working at the highest rarefactions.

Continuing the description of apparatus, the author describes different new forms which enable the phenomena of repulsion by radiation to be observed and illustrated. A bulb 3 inches diameter is blown at the end of a glass tube 18 inches long. In this bulb a fine glass stem, with a sphere or disk of pith, &c., at each end is suspended by means of a cocoon fibre. The whole is attached to the Sprengel pump in such a way that it can be perfectly exhausted, and then hermetically sealed. Besides pith, the terminals may be made of cork, ivory, metal, or other substance. During exhaustion several precautions have to be taken, which are fully entered into in the paper. To get the greatest delicacy in an apparatus of this kind, there is required large surface with a minimum of weight. An apparatus constructed with the proper precautions is so sensitive to heat that a touch with the finger on a part of the globe near one extremity of the pith will drive the index round over 90° , whilst it follows a piece of ice as a needle follows a magnet. With a large bulb, very well exhausted, and containing a suspended bar of pith, a somewhat striking effect is produced when a lighted candle is placed about 2 inches from the globe. The pith-bar commences to oscillate to and fro, the swing gradually increasing in amplitude until the dead centre is passed over, when several complete revolutions are made. The torsion of the suspending fibre now offers resistance to the revolutions, and the bar commences to turn in the opposite direction. This movement is kept up with great energy and regularity as long as the candle burns.

The author discusses the action of ice, or a cold substance, on the suspended index. Cold being simply negative heat, it is not at first sight obvious how it can produce the opposite effect to heat. The author, however, explains this by the law of exchanges, and shows that attraction by a cold body is really repulsion by radiation falling on the opposite side. According to the same law, it is not difficult to foresee what will be the action of two bodies, each free to move, if they are brought near to one another in space, and if they differ in temperature either from each other or from the limiting walls of the space. The author gives four typical cases, with experiments, which prove his reasoning to be correct.

Experiments are described with the object of ascertaining whether the attraction by heat, which, commencing at the neutral point, increases with the density of the enclosed air, will be continued in the same ratio if the apparatus is filled with air above the atmospheric pressure. This is found to be the case.

Various experiments are described with bulb-apparatus, in which the bulb is surrounded with a shell containing various adiathermous liquids, and also with a shell of vacuum. In all cases radiation passed through, producing the normal action of attraction in air and repulsion in a vacuum.

The author next describes a form of apparatus by which measurable results are attainable. It consists of a long glass tube, with a wider piece at the end. In it is suspended a lump of magnesium by a very fine platinum wire, the distance between the point of suspension and the centre of gravity of the magnesium bob being 39.14 inches. Near the magnesium is a platinum spiral, capable of being ignited by a voltaic battery. Observations of the movement of the pendulum are made with a telescope with micrometer eyepiece. With this apparatus a large series of experiments are described, starting from air of normal density, and working at intermediate pressures up to the best attainable vacuum. The results are given in two tables.

With this apparatus it was found that a candle-flame brought within a few inches of the magnesium weight, or its image focused on the weight, and alternately obscured and exposed by a piece of card at intervals of one second, will soon set the pendulum in vibration when the vacuum is very good. A ray of sunlight allowed to fall once on the pendulum will immediately set it swinging.

The form of apparatus is next described which the author has finally adopted, as combining the greatest delicacy with facility of obtaining accurate observations, and therefore of getting quantitative as well as qualitative results. It consists of a glass apparatus in the shape of an inverted T, and containing a horizontal glass beam suspended by a very fine glass thread. At the extremities of the beam are attached the substances to be experimented on, and at the centre of the beam is a small mirror from which a ray of light is reflected on to a graduated scale. The advantage which a glass thread possesses over a cocoon fibre is that the index always comes accurately back to zero. In order to keep the luminous index at zero, except when experiments are being tried, extreme precautions must be taken to keep all extraneous radiation from acting on the torsion-balance. The whole apparatus is closely packed all round with a layer of cotton-wool about 6 inches thick, and outside this is arranged a double row of Winchester quart bottles filled with water, spaces only being left for the radiation to fall on the balance, and for the index ray of light to get to the mirror.

However much the results may vary when the vacuum is imperfect, with an apparatus of this kind they always agree among themselves when the residual gas is reduced to the minimum possible; and it is of no consequence what this residual gas is. Thus, starting with the apparatus full of various vapours and gases, such as air, carbonic acid, water, iodine, hydrogen, ammonia, &c., at the highest rarefaction there is not found any difference in the results which can be traced to the residual gas. A hydrogen-vacuum appears the same as a water- or an iodine-vacuum.

With this apparatus the effect of exposing a torsion-balance to a continuous radiation is described, and the results are shown graphically. The effect of a short (11.3 seconds) exposure to radiation is next described, and the results are given in the form of a table.

In another table is given the results of experiments in which a constant source of radiation was allowed to act upon one end of the torsion-beam at a distance of 140 or 280 millims., various substances being interposed. The sensitiveness of this apparatus to heat-rays appears to be greater than that of an ordinary thermo-multiplier. Thus the obscure heat-rays from copper at 100° , passing through glass, produce a deflection on the scale of 3.25, whilst under the same circumstances no current is detected in the thermo-pile. The following substances are used as screens, and the deflections produced, when the source of radiation is magnesium wire, a standard candle, copper at 400° , and copper at 100° , are tabulated:—

Rock-salt, 20 millims. thick; rock-crystal, 42 millims. thick; dark smoky talc; plate glass of various thicknesses, both white and green; a glass cell containing 8 millims. of water; a plate of alum 5 millims. thick; calc-spar, 27

* Abstract of a Paper read before the Royal Society, April 27, 1875.

millims. thick; ammonio-sulphate of copper, opaque to rays below F; ditto, opaque to rays below G.

The author considers that these experiments show that the repulsion is not entirely due to the rays, usually called heat, *i.e.*, to the extreme- and ultra-red of the spectrum. Experiments have been tried with the electric and the solar spectrum formed with a quartz train, which prove the action to be also exerted by the luminous and ultra-violet rays. Some numerical data have been obtained, but unfavourable weather has prevented many observations being made with the solar spectrum.

The barometric position of the neutral point dividing attraction from repulsion is next discussed. The position of this point varies with the density of the substance on which radiation falls, the ratio of its mass to its surface, its radiating and conducting-power for heat, the physical condition of its surface, the kind of gas filling the apparatus, the intensity of radiation, and the temperature of the surrounding atmosphere. The author is inclined to believe that the true action of radiation is repulsion at any pressure, and that the attraction observed when the rarefaction is below the neutral point is caused by some modifying circumstances connected with the surrounding gas, but not being of the nature of air-currents.

The neutral point for a thin surface of pith being low, and that for a moderately thick piece of platinum being high, it follows that at a rarefaction intermediate between these two points pith will be repelled, and that platinum will be attracted by the same beam of radiation. This is proved experimentally; and an apparatus showing simultaneous attraction and repulsion by the same ray of light is described and illustrated in the paper.

The paper concludes with a discussion of the various theories which have been adduced in explanation of these phenomena. The air-current and electrical theory are considered to have been abundantly disproved. The following experiment is given by the author to show that Prof. Osborne Reynolds's hypothesis of the movements due to evaporation and condensation at the surface will not account for all the facts of the case, and that, therefore, he has not hit upon the true explanation. A thick and strong bulb was blown at the end of a piece of very difficultly fusible green glass, specially made for steam-boiler gauges. In it was supported a thin bar of aluminium at the end of a long platinum wire. The upper end of the wire was passed through the top of the tube and well sealed in, for electrical purposes. The apparatus was sealed by fusion to the Sprengel pump, and exhaustion was kept going on for two days, until an induction-spark refused to pass across the vacuum. During this time the bulb and its contents were several times raised to a dull red heat. At the end of two days' exhaustion the tube was found to behave in the same manner as, but in a stronger degree than, it would in a less perfectly exhausted apparatus, *viz.*, it was repelled by heat of low intensity and attracted by cold. A similar experiment was next tried, only water was placed in the bulb before exhaustion. The water was then boiled away *in vacuo*, and the exhaustion continued, with frequent heating of the apparatus to dull redness, for about forty-eight hours. At the end of this time the bar of aluminium was found to behave exactly the same as the one in the former experiment, being repelled by radiation.

It is impossible to conceive that in these experiments sufficient condensable gas or vapour was present to produce the effects Prof. Osborne Reynolds ascribes to it. After the repeated heating to redness at the highest attainable exhaustion, it is impossible that sufficient vapour or gas should condense on the movable index to be instantly driven off by the warmth of the finger with recoil enough to drive backwards a heavy piece of metal.

While objecting to the theories already advanced as not accounting for all the facts of the case, the author confesses that he is not as yet prepared with one to put in their place. He wishes to avoid giving any theory on the subject until a sufficient number of facts have been

accumulated. The facts will then tell their own tale. The conditions under which they invariably occur will give the laws, and the theory will follow without much difficulty.

Since the experiments mentioned in the foregoing abstract were concluded, the author has examined more fully the action of radiation on black and white surfaces. At the highest exhaustion heat appears to act almost equally on white and on lampblack pith, repelling them in about the same degree.

The action of the luminous rays is, however, different. These repel the black surface more energetically than they do the white surface. Taking advantage of this fact, the author has constructed an instrument which he calls a radiometer. This consists of four arms, suspended on a steel point resting on a cup, so that it is capable of revolving horizontally. To the extremity of each arm is fastened a thin disk of pith, lampblack on one side, the black surfaces facing the same way. The whole is enclosed in a glass globe, which is then exhausted to the highest attainable point and hermetically sealed.

The author finds that this instrument revolves under the influence of radiation, the rapidity of revolution being in proportion to the intensity of the incident rays.

Several radiometers, of various constructions as regards details, but all depending on the above-named discovery, were exhibited by the author at the Soirée of the Royal Society on the 7th inst., and numerous experiments were shown with them. The following table which gives the result of some experiments tried with one of the first-made radiometers (and therefore not so sensitive as more recent instruments), is copied from a card which was distributed during the evening:—

TIME REQUIRED FOR ONE REVOLUTION.

Source of Radiation.	Time in Seconds.
1 candle, 20 inches off	182
" " 10 " "	45
" " 5 " "	11
2 candles, " " "	5
4 " " " "	3
8 " " " "	1.6
1 candle, " " " behind green glass	40
" " " " " " blue "	38
" " " " " " purple "	28
" " " " " " orange "	26
" " " " " " yellow "	21
" " " " " " light red "	20
Diffused daylight, dull	2.3
" " bright	1.7
Full sunshine, 10 A.M.	0.3
" " 2 P.M.	0.25

These experiments are not mentioned in the paper of which the above is an abstract, as it is intended to make the radiometer the subject of a future communication to the Society.

ON THE ANALYSIS OF CRUDE ANTHRACEN.

By GEORGE E. DAVIS and T. H. DAVIS.

(Concluded from page 180.)

IN Lück's method, the crude anthracen is dissolved in glacial acetic acid and oxidised with a large excess of an acetic acid solution of chromic acid. The anthrachinon formed cannot by this means be further oxidised; but how do the other constituents of crude anthracen act under this treatment? Crude anthracen may be supposed to contain, beside the easily expressible oil:—

1. Naphthalen, $C_{10}H_8$.
2. Acenaphthen, $C_{12}H_{10}$.
3. Fluoren, (?).
4. Phenanthren, $C_{14}H_{10}$.
5. Anthracen, $C_{14}H_{10}$.
6. Pyren, $C_{16}H_{10}$.
7. Chrysen, $C_{18}H_{12}$.

8. Reten, $C_{18}H_{18}$.
9. Benzerythren, (?).
10. Chrysogen, (?).

Now, the first, or naphthalen, is easily oxidised to naphthachinon, and thence to phthalic acid, and if any trace of this acid should remain mixed with the anthrachinon, it will be washed out by the dilute alkali used in the after process.

The next, or acenaphthen, is converted by the aceto-chromic acid into naphthalic or naphtho-phthalic acid, the sodium salt of which is easily soluble in water. Acenaphthen is, therefore, easily eliminated.

Of the third, or fluoren, very little is known; but, as it is associated with acenaphthen, and melting at a little over $100^{\circ}C$., we have every reason for believing that it is eliminated in the process of oxidation.

The fourth, or phenanthren, the isomer of anthracen, is oxidised by chromic acid in acetic acid solution to phenanthrachinon, and this rapidly, after which a slow oxidation sets in, and the phenanthrachinon is oxidised to diphenic acid, a body having the same percentage composition as alizarin, and soluble in dilute alkali.

On anthracen it is needless to dilate. It is oxidised to anthrachinon, and there the oxidation stops, and the product is insoluble in dilute alkali.

The sixth on the list is pyren. This hydrocarbon is acted upon by aceto-chromic acid very energetically, with the formation of pyrochinon, and this is acted upon by an excess of chromic acid, and, according to R. Lucas (CHEMICAL NEWS, vol. xxx., p. 190), is converted into a substance soluble in dilute alkali.

The seventh, chrysen, is converted, by oxidation, into chrysochinon, and then, by prolonged digestion, Lucas states that, with a large excess of chromic acid, the product is soluble in dilute alkali. That this is the case we have inferred from some of our own experiments; but with chrysen there sometimes exists another hydrocarbon, possessing a much higher melting-point: this is obtained during the coking of pitch, and we here express a doubt whether this hydrocarbon is capable of being oxidised by chromic acid in acetic acid solution, at least in any ordinary length of time.

Number eight is reten. This polymer of acetylene, when heated with aceto-chromic acid, splits up; a lower carbon compound is formed, dioxyretisten, $C_{16}H_{14}O_2$, and the solution yielding phthalic anhydride. Dioxyretisten is a brick-red powder, which crystallises from alcohol in long flat orange-coloured needles, but very slightly attacked by aceto-chromic acid, and insoluble in dilute soda solution. By giving the chromic acid a long time to act, and using it in large excess, we believe that dioxyretisten may be further oxidised and rendered soluble in dilute alkali; but we have no experiments made upon absolutely pure reten, and we argue from this standpoint that, with sufficient time, and with a large excess of chromic acid, our weighed anthrachinons possessed only the pale yellow colour characteristic of anthrachinon, and did not give us any reddish coloured residue, even when crude anthracen was operated upon, which we knew, from the conditions of manufacture, ought to have contained reten.

Number nine, or benzerythren, has been ascertained by Lucas to be oxidised to a product soluble in dilute alkali. Very little is known about benzerythren and its oxidation, but it is very probable, by the experiments of Lucas, that it in no way interferes with the application of Lück's method of analysis to crude anthracen.

In number ten we have chrysogen, which is contained in much larger quantities in some parcels of crude anthracen than in others. It is entirely converted into products soluble in weak caustic soda solution; not a trace remains unoxidised.

In some samples of crude anthracen there exists a dark green hydrocarbon, which is much less soluble in glacial acetic acid than the other constituents of the crude article. This hydrocarbon fuses at $271^{\circ}C$., and is a most difficult substance to oxidise when not thoroughly in solution; in

solution, even, it is very obstinate, and resists oxidation for a long time. Fortunately, this hydrocarbon does not occur frequently, and its presence is easily detected.

In order to thoroughly test Lück's anthrachinon method, we saw it was first necessary to prepare pure anthracen, an operation in which we foresaw no small difficulty, and fully experienced it.

After getting rid of the more fusible oils from the crude anthracen and some of the higher fusing ones, the product was boiled with alcoholic picric acid; but, as this method would not give us absolutely pure anthracen, it was abandoned, and we failed to get pure anthracen by this method, because acenaphthen, chrysen, and probably benzerythren form also crystalline compounds with picric acid.

From some samples of crude anthracen it is next to impossible to prepare the pure article, and, after spending nearly two months on a particular sample, we were obliged to give the experiments up and commence working on a new parcel, from which we had very little difficulty in preparing pure anthracen.

The sample upon which we worked showed 56.0 per cent of anthracen by the bisulphide method and 39.016 per cent by the anthrachinon method, the parcel being actually sold on a 56 per cent basis. This was the parcel we abandoned, and worked instead upon one which contained 41.088 per cent of real anthracen, and nearly 60 per cent by the bisulphide method.

A large quantity of this anthracen was taken and digested for three hours with carbon disulphide, in proportion rather less than in a "bisulphide" analysis, filtered off by the aid of the Bunsen pump, and washed with carbon disulphide upon the filter until the filtrate came away colourless; the action of the pump was then kept on to dry the mass. The filtrate, when evaporated to dryness at the temperature of the air and fused at $100^{\circ}C$., contained 14.021 per cent of real anthracen, showing that more impurities were dissolved out than in an actual bisulphide analysis. The residue upon the filter should then contain more real anthracen; it did, containing 70.192 per cent. This bisulphide residue was warmed to $30^{\circ}C$. with light petroleum oil, and filtered warm; the filtrate came through at first brownish yellow, and when cooled deposited a little anthracen coloured by chrysogen. The residue on the filter was washed with petroleum until the washings came away colourless, and well dried by means of the pump. This residue was then warmed with ether, filtered, and washed on the filter with warm ether until the ether ran through colourless.

This ether solution was placed in a retort, and the ether three-fourths distilled off, the remainder being evaporated on the water-bath, which left a white fatty-looking residue containing 9.039 per cent of real anthracen. The residue from the ether washing was boiled with alcohol in large excess and filtered; the residue was of a very green colour, and contained 82.176 per cent of real anthracen.

This residue was then mixed with some other alcohol, bisulphide, and ether residues containing from 80 to 90 per cent of real anthracen, and well washed with carbon disulphide and then with ether. The residue, after being well dried, contained 90 per cent of anthracen.

This 90 per cent substance was then cautiously sublimed, whereby the green colouring matter became carbonised, and also most of the chrysogen, and the sublimate, after being washed with ether and warm alcohol, contained 97.875 per cent of anthracen. This was taken and dissolved in a slight excess of boiling alcohol, filtered boiling hot, and allowed to crystallise. The crystals were washed with cold alcohol, and dried at $100^{\circ}C$. Three analyses were made, as follows:—

	Pure Anthracen.
	Per cent.
1.	99.124
2.	99.506
3.	99.477
Average	99.369

The fusing-point of this sample was made by us as follows:—

	° C.		
1.	212.5	T. H. D. }	With small sulphuric
2.	212.0	T. H. D. }	acid bath.
3.	212.8	G. E. D. }	With very large paraffin
4.	212.8	G. E. D. }	bath slowly heated.

In the third and fourth experiments, the anthracen was placed between two small thin glass test-tubes, one inside the other and nearly touching, to secure actual contact of the anthracen with the glass, and to ensure no appreciable thickness of non-conducting material, and to make everything more uniform, the inner test-tube was partly filled with mercury.

Some of this anthracen was sealed up in air in small tubes, and exposed in the lower half of the tubes to the heat of a water-bath. A very slight sublimation was obtained in four hours, and the crystals in every case did not assume any *regular* crystalline form. Some was then sealed up in a Sprengel vacuum, and, after an hour's heating at 100° C., well-defined six-sided plates were obtained, mixed, however, with many ill-defined crystals; and it may be interesting to remark that the anthracen (sublimed), containing less than 99.3 per cent of anthracen by the anthrachinon method, gave quantities of four- and five-sided tables, which were not to be found in the 99.3 per cent sample.

In order further to try the process, we made the following experiments:—

We first examined six samples of crude anthracen, with the following results:—

No. of Sample.	Anthracen by Anthrachinon. Per cent.
1.	19.842
2.	23.020
3.	41.477
4.	39.444
5.	14.021
6.	9.039

(a). A mixture was made of 1 grm. of each of the above. Two analyses were made of the mixture:—

	Anthracen. Per cent.
1.	24.166
2.	24.210

The arithmetic mean of the mixture would be 24.474.

(β). Two grms. of No. 3 were mixed with 3 grms. of No. 5, and the mixture gave as under:—

	Anthracen. Per cent.
1.	25.333
2.	25.279

The mean of the mixture should have been 25.003.

(γ). One grm. of No. 4 was mixed with 4 grms. of No. 6, when the following results were obtained:—

	Anthracen. Per cent.
1.	15.000
2.	14.876

The mean of the mixture being 15.120 per cent.

(δ). Half a gramme of No. 4 was mixed with 0.5 grm. of the pure anthracen, and when examined gave 70.0 per cent, instead of 69.722, the mean.

As to several good analysts working by the anthrachinon method upon the same sample, we give the following results, calling the analysts A, B, and C. They were 100 miles apart, working with their own reagents in different laboratories.

	A.	B.	C.
1.	31.17	31.64	—
2.	30.87	31.18	—
3.	—	65.05	65.03
4.	—	38.91	39.44

We have now shown that, if the process is properly worked, it will give accurate and reliable results perfectly uniform in themselves. We must now consider how the

process is to be properly worked, and give a few instances of departures from the general method.

To work the process, are required the following reagents and apparatus:—

(1). Glacial acetic acid; and care should be taken that it is the strongest acid procurable.

(2). Chromic acid. This may be readily obtained in large, pure crystals; should, however, it be found difficult to obtain, the method of preparing it, as given in Thorpe's "Quantitative Analysis," p. 236, may be employed. The chromic acid must be free from lead-salts, and, in fact, from any trace of any insoluble impurity.

The oxidation should be performed in a flask of 200 c.c. capacity; this should be fitted with a caoutchouc stopper having two holes, into one of which is inserted a pipette furnished with a stop-cock, and into the other a glass tube 3 feet in length, 5 m.m. internal bore at bottom, where it enters the cork, and 10 m.m. at the top.

This tube acts as a condenser, and prevents any rapid loss of acetic acid in the process. We at first used open flasks, adding fresh acetic acid as the original quantity evaporated; then we adopted the double perforated cork, containing a pipette and a tube 1 foot in length, and still there was a large loss of acetic acid. Mr. Lucas's practice is to use a tube 3 feet in length, and we have found that with such a length there is very little loss through volatilisation, and an oxidation can go on by its use without much attention from the operator.

We have used the Bunsen pump as an aid to filtering, but only in that it became the means of shortening the time spent on an analysis, washing the anthrachinon much quicker and with much less fluid than the ordinary way, and facilitating the drying.

The Process.—This has been described before, but no special precautions have been mentioned, therefore we do not think it out of place to describe exactly how we operate. The crude substance is well broken up to powder, well mixed, and a fair average sample taken. Some crude parcels can be well sampled, especially if steam-pressed, and the crystallised article can be easily sampled, as the particles do not cohere, as in the case with very low strength and greasy samples, which require more care to sample fairly.

One gramme of this sample is taken and placed in the 200 c.c. flask; 50 c.c. of glacial acetic acid are then added, and the flask closed with the cork and tubes. This is placed upon a hot plate until the crude substance has all dissolved. Should any insoluble matter be left behind, a longer digestion may be given, and should any residue remain, the contents of the flask must be filtered boiling, and the filter washed with boiling glacial acetic acid. The pipette is then to be filled with 15 grms. of chromic acid in 2 c.c. of water and 10 c.c. of glacial acetic acid, and while the solution in the flask is boiling, the chromic acid is to be admitted drop by drop. High percentages of anthracen will take much less than 15 grms., but it is always well to add a large excess, as it will probably save going over the analysis again.

The flask is kept boiling on the hot-plate for at least three hours (Lucas), and in some cases four hours will be required. We think that, where occasional samples only are done, that it would be as well to give all four hours, for there is no inconvenience attached to such a digestion; the only attention a sample requires is in the first half hour, when running in the chromic acid.

After being sufficiently oxidised, which nearly every sample will be in four hours, the flask is cooled and diluted to 200 c.c. After standing all night, the contents of the flask are poured through a filter, preferably Swedish, and well washed with water. After washing with water, it is next washed with a dilute solution of sodium hydrate, sp. gr. 1.04, and then again thoroughly washed with water. The pure anthrachinon is then dried at 100° C., and weighed; 0.01 grm. is then to be added for the solubility of the chinon in acetic acid, and the weight obtained multiplied by the factor 0.8556 to reduce it to anthracen.

Some have objected to this process on account of the addition of 0.01 for solubility; for our own part, we do not see why such an addition should not take place, the more especially when the solubility of anthrachinon in acetic acid is such a definite and constant quantity. Our own determinations, both in pure acetic acid and in the filtrates from anthrachinons, only prove Lück's figures, 0.009 in pure acetic acid, and 0.01 in the same acid mixed with the acid products of the oxidation of crude anthracen.

The filters used in the process should, before weighing, be washed first with acetic acid, next with water, thirdly with sodium hydrate, and lastly with water again, and finally dried at 100° C. This brings them into the same condition as after the filtration of the chinon, and no error is introduced here.

The anthrachinon must be of a uniform very pale yellow colour. Should it be in any way orange, owing to the presence of phenanthrachinon, it is the better plan to reject the experiment and commence again, giving a much longer oxidation, when the yellow anthrachinon will most probably be obtained.

Whatever may be the composition of the green hydrocarbon with such a high melting-point (about 271° C.), it certainly is not oxidised by chromic acid. Fortunately, it is not very soluble in acetic acid, and it may, therefore, for the most part, be separated by filtration; and it is only in a few samples that this compound has been discovered.

We now give a few results comparing the three processes side by side, when the enormous variations may be readily seen:—

No.	Alcohol, 0.830.	Carbon Disulphide.	Anthrachinon.
1.	37.782	26.375	27.810
2.	56.120	42.200	34.880
3.	43.000	33.460	28.200
4.	36.450	22.000	23.300
5.	37.340	23.500	24.000
6.	36.730	23.300	23.950
7.	35.620	19.900	22.500
8.	38.740	25.900	24.950
9.	39.150	29.400	26.200
10.	52.800	40.500	32.940
11.	73.000	56.600	39.444
12.	71.452	56.400	39.016

With this we conclude, hoping that those chemists and operators working at this subject may find something useful and interesting, even if not novel to many. What we have principally aimed at was, to get an anthracen showing near 100 per cent by the anthrachinon test of Lück, and exhibiting the same crystalline structure when sublimed at low temperatures. This we have done, and now rest satisfied that the anthrachinon method, in spite of all that has been said against it, may be relied on.

APPARATUS FOR OBTAINING SULPHURETTED HYDROGEN.

By SERGIUS KERN, St. Petersburg.

For the purpose of obtaining this gas very complicated apparatus are in use in laboratories, Kipp's apparatus being generally preferred.

I offer, a simple apparatus, very suitable, especially for mining explorations, when, as is generally the case, only a box with a few reagents and apparatus happens to be at hand. A glass tube 0.2 metre long, and 0.05 metre diameter, is closed at the lower end by means of a cork covered with melted wax. Then nearly the half of the tube is filled with diluted sulphuric acid, and a cork, also covered with wax, 0.005 metre thick, with small holes the size of a thick pin, is introduced into the tube to the middle of it. On the top of this cork small pieces of ferrous sulphide (FeS) are placed. Next, the upper part of the tube is corked. Through this cork passes a bent glass tube fitted with a gutta-percha one

with a Moor's screw. For receiving a jet of sulphuretted hydrogen, the screw is opened, and the tube is inclined in such a manner as to bring the acid solution in contact with the ferrous sulphide.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

April 24th, 1875.

W. SPOTTISWOODE, LL.D., F.R.S., in the Chair.

Mr. J. BARRETT exhibited an "auxiliary air pump" which is a modification of Poggendorff's arrangement for obtaining a Torricellian vacuum, and is also allied in principle to the exhaustor used by Geissler in the preparation of vacuum tubes. The following is a description of the instrument, but it is difficult to explain its action without the aid of a diagram:—A cylindrical glass vessel containing about 60 lbs. of mercury, is connected by a glass tube $\frac{3}{4}$ of an inch in diameter, with another similar vessel, which is placed about 18 inches above it. The upper vessel is divided near the top into two parts, which are connected by a short neck. The tube communicating with the receiver passes into this vessel, and is alternately opened and closed below the neck as the mercury rises and falls by a floating valve. This upper vessel is in permanent connection with a glass vessel at the back of the instrument, which is rendered vacuous in the ordinary way, and the mercury keeps its place in the upper vessel until the lower one is rendered vacuous by the air pump. A platinum valve in the back of the upper vessel retains a certain quantity of mercury, when the bulk of the mercury (with which the whole vessel is filled at the commencement of operations) falls by its weight into the lower vessel, which, as has been stated, is rendered vacuous by the air pump. The interval between the two volumes of mercury is a Torricellian vacuum, into which the residual air flows, through the floating valve, which again closes as the mercury rises in the upper vessel and forces through the platinum valve, and upper column of mercury, the air which has entered from the receiver. It is possible to obtain a very good vacuum in a large receiver by the aid of this instrument.

Mr. BARRETT also showed a hammer break for the instantaneous rupture of the current in the primary wire of an induction coil. It is impossible to explain it clearly without a diagram, but an upright swing hammer is kept constantly vibrating by the alternate action of a spring and the magnetic break.

Dr. W. H. STONE read a paper "*On some Points Connected with Wind Instruments.*" He stated that discrepancies might be noted in the behaviour of air issuing from the side orifices of wind instruments. These discrepancies deserve attention, and may be accounted for by the laws of efflux. He showed that the stream of air from the side hole of a clarinet was sufficient to extinguish a candle, though the musical vibration was obviously in the main tube. It is usual to tune such instruments by introducing a resinous cement into the holes so as to diminish their calibre, but after a certain point is reached the rounded surface thus obtained ceases to produce an effect. If a short pipe of the same diameter as the orifice be now inserted, auxiliary vibrations are set up, and a definite note may be produced. Dr. Stone was led to enquire whether the theorem of D. Bernoulli, or the particular case of it named after Torricelli, could be brought to bear on the question. The *vena contracta*, which in fluids reduces the efflux to 0.62 of the calculated amount, is also to be noticed in gases, and the nature of the effluent column of air is affected by three conditions:—(1) The thickness of the wall in which the orifice is made; (2) the shape of the

nozzle; (3) friction in a long pipe. Some mathematical details were then given respecting these conditions, and it was admitted that the vibration in a musical tube must also exercise sensible influence. There are two functions in a side orifice in an instrument; the first is to cut off a portion of the tube, and by this means to raise the pitch; the second establishes a point of non-resistance in the wall of the tube, and thus acts by influencing the longitudinal vibrations. In the organ, peculiar qualities of tone are often obtained by these side holes, as in the "viol-di-gamba" and "keraulophon" stops. In flutes, oboes, clarinets, and other instruments, much of the tone comes from the bell, even when the side holes are open. In instruments in which the holes are long, as in the bassoon, the holes themselves become separate vibrating tubes. This was shown by introducing tubes of different and increasing lengths into an orifice in the side of an organ reed-pipe. The friction at last became so great, and the secondary wave so strong, that the organ-pipe returned to its original pitch. A reed was also applied to a cylindrical tube, and it was shown that a sharp-edged orifice opened at the middle point of the tube rendered it impossible to produce any note until a cylindrical nozzle was introduced, when the octave was sounded freely. The general results proved that lateral holes had a double function, the pitch of the notes emitted varying with their size, shape, and length, the actual severing of continuity in the principal tube being a comparatively minor point. Dr. Stone then inserted three tubes, varying in length from 2 to 6 inches, in a cylindrical tube like that of a clarinet, at right angles to its length, the longest being placed at the centre of the instrument, and the shortest at one-eighth from the mouth-piece. The same note was produced when each tube was used singly, and when the three were employed; and Dr. Stone expressed a hope that a series of experiments would render it possible to develop curves, in which the co-ordinates would be the lengths of the additional tubes and their position in the instrument. He also considered that a new instrument might be produced, in which the side orifices acted purely as nodal points, by the assistance of friction and the contracted vein.

SOCIETY OF PUBLIC ANALYSTS.

MEMBERS are informed that the next ordinary meeting of this Society will be held on Wednesday next, May 5th, at Cannon Street Hotel, at 4 p.m., when it is hoped that the importance of the business will ensure a large attendance. The Council will present a special report as to the steps they have taken in reference to the "Sale of Food and Drugs Bill, now before Parliament, and the further action which they suggest as desirable. Amongst the papers to be read and discussed will be the following:—"On a Simple Method of taking the Melting-Point of Fats," by J. W. Tripe, M.D.; "On Angell and Hehner's mode of Determining the Fusing-Point of Fats," by Arthur Angell; "On a Method of taking the Melting-Point of Fats," by Charles Heisch; "On the Minimum of Solids in Milk," by J. Campbell Brown, D.Sc., &c.; "Practical Suggestions as to the best Method for Public Analysts to adopt in reference to Local Boards, Inspectors, &c., especially as to the Receiving, Dividing, Sealing, and Reporting on Samples," by G. W. Wigner; "On Milk Ash," by J. A. Wanklyn, M.R.C.S., and A. A. Nesbit; "On Tartaric and Citric Acids," by A. H. Allen.

ADULTERATION NOTES.

DR. CAMERON has recently submitted to the grand jury his annual statement of the analytical work performed by him as Public Analyst for the County of Dublin. From this statement we learn that the total number of samples analysed during the year was 78; 28 of these were found to be adulterated, and 13 convictions were the result. The total amount of the penalties was £48.

In the previous year, the samples analysed were 88 (against 78); number of convictions obtained, 17 (against 13); penalties imposed, £88 (instead of £48). Thus, though the number of samples taken and the number of convictions obtained in the two years was very nearly the same, the amount of the fines imposed in the more recent year was only about half. Does this mean that smaller fines are being inflicted for the same offences, or that the adulteration practised is of a more innocent kind than formerly?

It appears that the grand jury, on receipt of Dr. Cameron's report passed a resolution requesting the Government to strike out the word "knowingly" wherever it occurs in the "Sale of Food and Drugs Bill," and to amend the measure in some other respects.

Mr Wigner, Public Analyst for Greenwich, Plumstead, and Woolwich, at the request of the Plumstead District Board of Works, presented to that body, in the early part of the present month, a comprehensive report on the working of the Adulteration Act since the date of his appointment. From this report, it appears that, in the district of Plumstead, his examination has extended to a great variety of articles. The report points out that, taking the entire term, the proportion of adulterated articles in Plumstead has been about 10 per cent of the whole; whereas from published reports it would appear that the average proportion of adulteration, in an aggregation of forty or fifty other districts, is about 27 per cent. The Analyst notices that certain kinds of adulteration have sensibly declined; and, in the case of alum in bread, he states that, in the three extensive Metropolitan districts for which he acts, it is now all but unknown. On the other hand, in spite of special attention having been given to the article of milk, and numerous prosecutions instituted, it is a noticeable fact that comparatively little improvement has taken place. This Mr. Wigner attributes partly to the ease with which this adulteration can be effected (the presence of a pump and the absence of principle being the only two requirements), but mainly to the extreme leniency with which the Kentish magistrates have dealt with offenders. This view is certainly corroborated by a comparison of the police reports in some of the northern towns with those of Greenwich, Plumstead, and Woolwich. The report concludes with various suggestions in reference to the "Sale of Food and Drugs Bill" now before the House of Commons.

The Plumstead Board ordered a copy of this report to be sent to the Local Government Board.

The action of the two local authorities to which we have referred is, we think, to be commended, as being calculated to strengthen the hands of the Society in their efforts to amend the present Bill.

SOME RECENT PROSECUTIONS FOR ADULTERATION.

At the Frome Petty Sessions, Mr. F. Hoddinott, of Butt's Hill, was summoned for selling 2 ozs. of adulterated mustard to police-constable Westcott. Mr. Dunn appeared for the defendant, and called defendant's assistant, named Porter, who stated that he called the policeman's attention to a label on the tin in which the mustard was kept, which stated that it was a mixture of pure mustard with farina and other choice condiments; but this was denied by the policeman, and the defendant was fined 5s. and costs. The same defendant was also charged with selling 2 ozs. of adulterated tea to Westcott on the same day. The evidence showed that the sample which the policeman purchased was adulterated, to the extent of 5 per cent, with counterfeit tea and mineral matter, but was not injurious to health. Mr. Dunn, for the defence, produced a certificate to the effect that Messrs. Morgan and Harper, of Bristol, of whom the defendant purchased the tea, had had it analysed when in bond, and had pronounced it commercially good and free from deleterious impurity. The Bench said they must convict, and they fined the defendant 5s. and costs. Mrs. Rachel Ann Legg,

Mr. Henry Watson, and Mr. Edward Philp, grocers, of Frome, and Mr. Samuel Dodimead, of Mells, were each fined 5s., including costs, for selling adulterated mustard.

At Daventry, near Wellingborough, on Saturday, Mrs. Mary Smith, grocer, of Daventry, was charged with selling coffee adulterated with roasted acorns. Mr. Hepgate, of Wellingborough, appeared for the defendant. Mr. Browning, an inspector appointed under the Adulteration Act, said that on February 9th he purchased $\frac{3}{4}$ lb. of coffee at the defendant's shop, and was served by the manager, whom he told that the coffee was to be analysed. Witness sent a sample of the coffee to Dr. Young, who now certified that it had been examined, and found to contain 75 per cent of roasted acorns. In answer to the Bench the witness said that when he told the manager that the coffee was to be analysed he said—"All right; we buy it in the berries, and grind it ourselves." Mr. Hepgate said he could merely prove that the coffee was in the same state as when defendant bought it. The analyst had made one very significant remark to him—that this form of adulteration was peculiar to this county. It did seem a most extraordinary thing that the dealers of this county, and of this county alone, should have become possessed of an article of food adulterated to so large an extent, and of a kind not to be met with elsewhere. If, as he supposed, the dealers of this county obtained their supplies from wholesale houses in London, it seemed incredible that the adulterated article should find its way to this county alone. He thought the case ought to be adjourned, and this was a sufficient reason why his application should be conceded, and a further analysis be made. He thought the most thorough investigation should be made in this case, for no doubt it would be made a test case. It affected others beside his client, who obtained her coffee from Messrs. James Brothers, of Wellingborough, and also of Messrs. Travers and Co., of London. These gentlemen were most anxious for the matter to be sifted, for, he might add, this form of adulteration was unknown in the trade. The coffee was bought by the defendant in the berry state, when it might be supposed that a large admixture of roasted acorns would be noticeable. Mr. A. Roberts, manager to the defendant, said that he supplied the coffee from a drawer kept solely for ground coffee. The coffee was received from Messrs. James Brothers, of Wellingborough. Defendant dealt with no one else for coffee. It was bought in berry. Witness saw it in that state, but did not notice anything in particular. The coffee supplied to the inspector was ground on the previous day. It was roasted before it came to them. The Bench considered that the case had been made out, and inflicted a fine of 20s. and costs.

On Monday, at the Ramsgate Police-court, Mrs. Elizabeth Elgar, grocer, of the parish of St. Lawrence, was summoned under the Adulteration Act for having sold $\frac{1}{4}$ lb. of butter, which was stated to be adulterated. Mr. Watford, of Ramsgate, appeared for the defendant. Thos. Golding, an assistant to Inspector Taylor, said that on March 14th he was requested by Mr. Taylor to go to the defendant's shop and purchase $\frac{1}{4}$ lb. of butter, which he did, and paid 6d. for it. He afterwards handed the butter to Mr. Taylor, who took it to the county analyst. Dr. Adams, analyst, said that he had examined the butter, and found it was adulterated with 20 per cent of foreign fat. Mr. Watford, for the defence, contended that a conviction could not take place unless the defendant sold the butter knowing it to be adulterated, or unless the adulteration was proved to be injurious to the health of the person who consumed it. He called William E. Butler, who said he was an assistant to the defendant. The butter was sold in exactly the same condition as it was received from the wholesale shop, and it was believed to be a pure article. Mr. Fells, a wholesale grocer and cheesemonger, of Ramsgate, said that he supplied the defendant with the butter in question: it was sold at 1s. per lb. The Bench convicted the defendant, and fined her 5s. and costs; the Chairman observing that it was

upon the sellers alone that the Act of Parliament placed the responsibility of seeing that the articles they sold were not adulterated.

On April 14th, at the Brackley Police-court, Mr. George Kennedy, grocer, of Grimsbury, was charged with selling $\frac{1}{4}$ lb. of ground coffee, contrary to the Adulteration Act, on February 9th. Defendant was represented by Mr. Crosby. Inspector Botterell gave evidence as to the purchase of the coffee. On the 1st inst. he received a certificate from Mr. Young, to whom he had submitted the coffee for analysis, as follows:—"Percentage of ash, 3.68 per cent; specific gravity of 10 per cent decoction, 1.0068, equal to 16 per cent soluble matter; farina or starch, none; sugar or saccharine ingredients, traces. Microscopic appearance most unsatisfactory. Remarks: adulterated with at least 20 per cent of roasted acorns." Mr. Crosby said the coffee had been supplied to the defendant by Mr. R. Stevens, grocer, Banbury, who had instructed Mr. Beesley to analyse the sample left with the defendant. Mr. Thomas Beesley, analytical chemist, Banbury, said he had examined the coffee microscopically and chemically, and there was no adulteration present whatever. The case was adjourned, the coffee to be submitted to a third analyst. This adjourned case was heard on the 26th inst. Since the last hearing a further portion of the same sample had been analysed by Dr. Letheby, who, like Mr. Beesley, pronounced the coffee to be perfectly pure. The Bench dismissed the case, and told the Solicitor for the defendant to send in the amount of costs his client had incurred, and they would consider whether they should be paid.

NOTICES OF BOOKS.

The Disposal of the Slop-Water of Villages. By C. B. Fox, M.D. London: J. and A. Churchill.

ALL methods for disposing of the refuse of towns and villages seem doomed to leave a dangerous, or at least doubtful, residuum unprovided for. The water-closet system, whilst removing all excrementitious matters, soap-suds, &c., leaves such substances as oyster-shells, fish bones, tails, &c., the peels of potatoes and turnips, the outer leaves of cabbages, and, in short, an extensive assortment of animal and vegetable refuse, to ferment in the dust-bins. The dry-closet system, which Dr. Fox justly thinks best adapted to the wants of villages, is embarrassed with "slop-water." This fluid consists of soap-lyes, rinsings of plates, dishes, and the like, water in which vegetables have been boiled, and a small quantity of urine. Such a mixture is obviously distinct from sewage, and, both as regards its quantity and quality, is ill adapted for treatment by any "sewage" process. On the other hand, it is obviously unfit to be run into any stream the water of which is used for drinking or in cookery; nor can it, as is too often the case, be safely allowed to stagnate in pools and ditches.

Dr. Fox discusses at some length the various means of dealing with such "slop-waters." Of surface irrigation, whether with sewage properly so-called, or with slop-water, he does not feel at liberty to speak with approbation. "In the first place," says he, "I cannot refrain from expressing my doubts as to the wisdom of irrigating land on an extensive scale amongst the villages of our rural districts, impressed as I am with the fear that an augmentation of the amount of pulmonary consumption and other tubercular affections might occur. Physicians well know the intimate relation between dampness of soil and the prevalence of these diseases. The continued maintenance of acres of land in the immediate vicinity of nearly every village in a wet state is a measure attended with some hazard, which should not be overlooked."

We are much interested thus to find our own views on the sanitary results of irrigation confirmed by so acute and

thoughtful an observer. In a commercial point of view, he expects nothing from irrigation with slop-water. The cottagers of Shenfield, whose gardens have been irrigated with slop-water for six years, are well pleased at being able thus to rid themselves from a nuisance, "but the vegetables grown on the gardens so treated do not exhibit much benefit, if any, therefrom." On the other hand, in a careful experiment made by the author, "ground was rendered three times more productive by adding to it the contents of the earth-closet." This is an interesting little fact for "exploders of the sewage difficulty," who wish us to believe that *foecal* matters are worthless!

We have had great pleasure in reading this small, but suggestive, book, and consider it a very valuable contribution to sanitary literature.

The Analysts' Annual Note-Book, 1874. By SIDNEY W. RICH. London: Printed and published by the Author.

WE have here the first issue of a new yearly periodical, devoted exclusively to analytical chemistry. Such new or improved processes as have appeared during the past year are collected and arranged in alphabetical order. So far, therefore, the "Note-Book" is merely a reprint of matter which has appeared in the scientific journals or in independent works. From the preface, however, we learn that the author hopes to secure for future issues an "unquestionable practical value," and to present his readers with original matter, by means of the following plan:—He "will undertake to pay ten guineas to the contributor of the most valuable article, or series of notes for publication in the issue for 1875, on the conditions subjoined: (1) That there shall be at least three *bona fide* contributions; (2) that there shall have been no previous publication of the paper, or of the substance of the paper; (3) that there shall be no publication in any other form until six months after the publication of the "Analysts' Annual Note-Book" in which they first appear . . . ; (6) the papers must be sent in before the 31st of October, 1875."

We are by no means certain that this project, supposing it carried into execution, would have any beneficial effect on chemical science, or that it would be any convenience. At present, any new or improved analytical procedure is immediately made public; it "goes the round" of the scientific journals, it is discussed at the meetings of societies, and is experimentally tested by numerous and independent operators under the most varied circumstances. Under Mr. S. Rich's plan, a new method, say, for the determination of nitrogen, discovered in January or February, 1875, would not be in the hands of the scientific world until January, 1876. We fail to see the advantage of such a delay.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 12, March 29, 1875.

Researches on the Sugar Beet-root.—E. Fremy and P. P. Dehérain.—The authors infer from their experiments that beet-root can reach a normal development in a soil perfectly devoid of human, if they are watered regularly, and receive manures containing nitrogen, phosphoric acid, lime, and potash. The form in which the nitrogen is presented appears indifferent nitrates of potash and soda, sulphate of ammonia and nitrogenous organic matter all exerting a manifest action. Beet-roots cultivated in a soil which acts merely as a support, and nourished with chemical manures, may contain 18 per cent of sugar.

The chemical nature of the soil does not appear to have any sensible action on the development of the beet-roots; the same results having been obtained with soils consisting respectively of pure silica, of lime, or of a mixture of silica, lime, and clay. The beet-roots rich in sugar are poor in albumenoid matters, and inversely. Bad results may be obtained from the best seed if sown in a soil containing an excessive proportion of nitrogenous matter.

Pyroxenic Constituent of the Rock Associated with Platinum in the Ural.—M. des Cloizeaux.—The author has studied the crystallographic and optical characters of the mineral in question.

Dissolution of Hydrogen in Metals, and on the Decomposition of Water by Iron.—MM. L. Troost and P. Hautefeuille.—In previous researches on the metallic alloys formed by hydrogen (*Comptes Rendus*, lxxviii., 686 and 807), the authors indicated the characters which distinguish these definite combinations from the solutions of hydrogen in metals. Potassium, sodium, and palladium, combine with hydrogen, whilst a considerable number of other metals merely dissolve this gas. Iron, nickel, cobalt, and manganese offer striking analogies in the manner in which they behave with hydrogen at different temperatures. The facility with which they absorb or give off hydrogen gas depends greatly on their physical condition. An ingot of pure nickel gave out, in a vacuum, at a red heat, one-sixth of its volume of hydrogen. Laminæ of nickel, obtained electrolytically, gave out forty times their volume. Pulverulent nickel gave up one hundred times its volume, and remained pyrophoric after the escape of the hydrogen. An ingot of cobalt gave up one-tenth of its volume; electrolytic laminæ of cobalt thirty-five times their volume, and pyrophoric cobalt powder one hundred times. It also remained pyrophoric after the loss of the hydrogen. Soft iron in ingots gives off one-sixth of its volume, and grey cast-iron more than the half. Electrolytic laminæ of iron gave off 260 volumes. In fine, it may be said that iron, nickel, and cobalt absorb directly hydrogen gas, but it cannot be said that combination ensues, just as has been already shown in the case of lithium and thallium. Finely divided iron has a property which is not shared by nickel or cobalt: it decomposes water slowly at common temperatures, and rapidly at 100°. In this respect iron approximates to manganese.

Chemical Equilibrium between Gaseous Iodine and Hydrogen.—M. G. Lemoine.—This paper requires the accompanying diagram.

Rapid Process for the Detection of Lead in the Tin Lining of Vessels.—M. Fordos.—Place, with a tube plunged in pure nitric acid, a slight layer of acid upon any part of the tinning, selecting by preference the thickest parts. Both metals are attacked, forming stannic oxide and nitrate of lead. After a few minutes, heat slightly to expel the last traces of acid, and allow to cool; then touch the pulverulent spot produced by the acid with a tube dipped in a solution of 5 parts of iodide of potassium in 100 of water. The iodide has no action upon the oxide of tin, but with the nitrate of lead it reacts, forming yellow iodide of lead, and showing the presence of even a small quantity of this metal. The surface of the tinning must be carefully cleansed before applying the nitric acid, and the acid should not penetrate to the iron or copper which forms the body of the vessel, as the reaction might thus be complicated.

Relation between the Nature of Steels and their Coercitive Force.—MM. Trève and Durassier.—Not suitable for abstraction.

Internal Double Reflection in Birefrangent Uniaxial Crystals.—M. Abria.—Not adapted for abstraction.

Researches on the Uric Acid Group.—M. E. Grimaux.—The author has obtained parabanic acid as a product of the splitting up of the pyruvic ureides.

Gazzetta Chimica Italiana, Anno iv., Fascicolo 9 and 10, 1874.

Expansion of Phosphorus.—G. Pisati and G. de Franchis.—A very lengthy paper, and quite incapable of useful abstraction.

Action of Sulphur upon Water and upon Carbonate of Lime.—Prof. Tullio Brugnatelli and Dr. P. Pelloggio.—The authors have investigated the oxidation of sulphur in contact with water and carbonate of lime, and have concluded from their experiments that the oxygen of the atmosphere takes no part in this reaction.

Nature and Constitution of Tannic Acid.—Ugo Schiff.—This paper contains analyses of the tannates of ammonia, potash, soda, baryta, antimony, bismuth, copper, mercury, cadmium, lead, and iron. There are also some remarks on the composition of laurostearin, and on the correction of old organic analyses, in the calculation of which incorrect equivalents have been employed.

Measurement of the Indices of Refraction of Cymen, Benzol, and some Derivatives of Natural and Synthetic Thymol.—G. Pisati and E. Paterno.—Not adapted for abstraction.

Economical Chrome Green.—Adolfo Casali.—The author states that the existing chrome greens, such as Guignet's green (hydrated sesquioxide of chrome), called also emerald green, and Pannetier's green; green ultramarine (anhydrous chromic oxide), Leune and Castelholz's green (hydrated chromic oxide), Arnaudon's green (chromic metaphosphate?), Matthieu Plessy's green (phosphate), leave little to be desired in point of beauty, and are free from injurious properties, but are too expensive to compete with the arsenical greens. He proposes in their stead to calcine strongly an intimate mixture of 1 part of bichromate of potash and 3 parts of baked gypsum, of the variety commonly known as scagliola. The result is a grass-green mass, which, on boiling with water, or mixing with dilute hydrochloric acid, leaves a fine powder of an intense and beautiful green, and possessing a very high colouring power.

Detection of Amylic Alcohol in Spirit of Wine.—Dr. Ciro Betelli.—Dilute 5 c.c. of the suspected alcohol with 6 or 7 volumes of water. Add 15 or 20 drops of chloroform, shake strongly, and leave at rest. The deposit of chloroform is collected, and allowed to evaporate spontaneously, when the amylic alcohol is left as a residue, and may be recognised by its well known odour, its reaction with sulphuric acid, &c.

Volumetric Process for the Determination of Phosphoric Acid.—J. Macagno.—The author proposes to determine the molybdic acid in the phospho-molybdic precipitate, and calculate from it the phosphoric acid. He acidulates the alkaline solution of the molybdic precipitate with hydrochloric or sulphuric acid, and adds zinc. The molybdic acid is reduced to sesquioxide with an intense brown colour. On treating this with a standard solution of permanganate, the sesquioxide returns to the state of molybdic acid, and the liquid becomes colourless. The phospho-molybdic precipitate, dried at 100°, has the following composition:—

Molybdic acid	90.744
Phosphoric acid	3.142
Ammonia	3.570
Water	2.544

100.000

Revue Universelle des Mines, de la Metallurgie, de Travaux Publics, des Sciences et des Arts Appliqués à l'Industrie, January and February 1875.

The Rotatory Puddling Furnace of Mr. Crampton, and Bessemer Steel Works.—M. A. Habets.

Magnetic Observations made in Belgium in 1871.—Stephen L. Perry.

Report on the Mineral Industry of Italy in 1873.—M. Jules Axerio.

Production and Consumption of Coal.—Victor Bouhy.

Note on a Steam-Boiler Accident, due to the Extraordinary Thinness of Sheet-Iron.—M. van Hees.

Geometric Demonstration of Zeuner's Diagram.—M. Armand Reigler.

Concessibility of Iron Mines.—M. Descamps.

The Electric Light.—A notice of the improvements effected by M. Ladyguine.

Mining Industry of Algeria.—Besides excellent iron ores, there are in Algeria deposits of zinc, lead, and copper.

Warner's Procedure for the Purification of Cast-Iron.—M. E. Rigo.

Action of Cold upon Iron and Steel.—An account of J. P. Joule's experiments, taken from *Iron*.

Cousin's Parachute.—M. Gille.

Electro-Dynamic Machine, and Electric Light Regulator of Siemens and Halske.—With diagrams.

MISCELLANEOUS.

Incorporation of the Royal Veterinary College.—We are glad to find that the Queen has been pleased to grant Her Royal Charter of Incorporation of the Royal Veterinary College. Among the powers bestowed on the College is one of creating scholarships, and of awarding medals, prizes, and certificates of distinction to the students. When to this is added the power of appointing former students of the College Licentiates, or those who have practised with particular distinction in their profession, Fellows of the College, with a right to use these distinctions publicly, it will be seen that the means of elevating the profession do not stop with the mere obtaining of scholastic honours as a stimulus to progress. The Charter also empowers the Governors to bestow the higher honour of Honorary Associate on distinguished persons, native or foreign, who have contributed in an especial manner to elevate veterinary science.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the preparation of ozone and ozotic acid, and in apparatus used therein. Bristow Hunt, Serle Street, Lincoln's Inn, Middlesex. (A communication from Alvaro Francisco Carlos Reynoso, chemist, Paris.) June 23, 1874.—No. 2181. Preparation of ozone. The fundamental principle of novelty in the preparation of ozone consists in operating upon oxygen gas compressed to several atmospheres. Electric sparks are caused to pass through the mass by means of particular arrangements, which increase the surfaces and multiply the number of the electric sparks. The apparatus is composed of a vessel capable of resisting great pressure. The electric sparks are disengaged between two conductors terminated by several points placed at suitable distances. Preparation of azotic acid and azotates by means of compressed air. Air is compressed to several atmospheres above water, or alkaline bases, or carbonates, and through the same are passed electric sparks produced by means of a "Ruhmkorff" coil placed in communication with an electro-magnetic machine moved either by hydraulic power, the wind, by compressed air, or otherwise. The sparks will be disengaged by points or systems similar to those above mentioned with regard to ozone.

Improvements in materials or compositions for destroying insects on animals, plants, and other objects, and for protecting them therefrom. Alexander McDougall, Penrith, Cumberland. June 25, 1874.—No. 2208. This invention consists in the admixture of the composition described in the Specification of Letters Patent, No. 2510, 1860, with sulphur and a liquid obtained by washing the oil produced between the spirit or naphtha and the pitch in the destructive distillation of carbonaceous substances with an alkali; also in taking carbolic acid other than "crude carbolic acid," and making it into a paste or composition in a manner similar to that described in the aforesaid Specification, and adding sulphur thereto.

Improvements in the process of rendering alkalies caustic, and apparatus for that purpose. John Imray, Southampton Buildings, Chancery

Lane, Middlesex. (A communication from Hermann Kühne, Magdeburg, Germany.) June 29, 1874.—No. 2242. According to this invention a heated solution of carbonate of potash or soda is mixed with quicklime in a vessel so as to render the alkali caustic, and the mixture is then run into a lower vessel having an opening at bottom covered with a sieve, over which is spread a layer of gravel and sand: the caustic alkali filters through this layer, leaving the carbonate of lime deposited on the filter. When the alkali has filtered through, the vessel is filled with water so as to force out the residue of alkali held by the deposited lime, and this, together with the water, is then discharged through a flap-valve. A number of the lower vessels are arranged in combination with one upper vessel, so that each of the former receives a charge from the latter in rotation.

An improved composition for coating the hulls or bottoms of iron ships, to preserve them when in sea or other water, also applicable for the like preservation of any iron, wood, or stone. James Burrell, marine engineer, Hammersmith, Middlesex. June 29, 1874.—No. 2248. The coating is made of two distinct compositions, the one being mixed with any drying oil, and the other with any undrying oil. The two compositions will be used either separately or combined: if used together the drying composition to be used first, and afterwards the undrying composition. But in some cases it is not absolutely necessary to use any of the drying composition, as ordinary paint can be used first, and then the undrying composition may be put on over it. The coating composed of the material hereinafter named is to be ground or pulverised quite fine, and mixed together and thoroughly incorporated, and it should be of the consistency of thick paint. The several proportions, however, may be varied to suit the different purposes, or some of the material may be left out altogether. The colour can also be altered or varied by adding any suitable colouring matter. For the making of the first composition I propose to employ of—

Cinnabar	about 15 parts.
Calamine.. .. .	" 10 "
Rosin	" 20 "
Chalk or lime.. .. .	" 85 "
Arsenic (any colour) ..	" 10 "
Any drying oil or varnish	" 10 "
Petroleum or turpentine	" 8 "
Sugar of lead	" 2 "
Red lead or red oxide ..	" 10 "

Total 100 parts.

Another composition or a modification of the above will be made as follows:—

Sulphur	about 16 parts.
Mercury	" 4 "
Arsenic (red)	" 10 "
Oxide of zinc	" 10 "
Sugar of lead	" 4 "
Rosin or bitumen	" 20 "
Red lead or any colouring material	" 6 "
Any drying oil or varnish	" 10 "
Petroleum or turpentine	" 10 "
Chalk or lime.. .. .	" 10 "

Total 100 parts.

The chalk or lime is to be subjected before mixing to the action of coal-gas, or carbonic acid gas, or the two combined. If chalk is used it is to be perfectly dry, then broken quite fine, and enclosed in a close box or case, and it is to be continually moved, so that all parts will be submitted to the action of the gases. In the making of the second or last coating I employ of—

Cinnabar	about 20 parts.
Calamine or oxide of zinc	" 20 "
Prepared chalk or lime ..	" 20 "
Arsenic	" 10 "
Sugar of lead	" 5 "
Any drying oil that will cause the materials to adhere together	" 25 "

Total 100 parts.

A variation or modification of the above or last coating will be made as follows:—

Sulphur	about 16 parts.
Mercury	" 10 "
Arsenic	" 14 "
Prepared chalk or lime	" 20 "
Oxide of zinc	" 10 "
Red lead, or red oxide of iron, or any suitable colouring material ..	" 5 "
Any undrying oil that will cause the materials to adhere together ..	" 25 "

Total 100 parts.

Or a further composition may be made of sulphur, mercury, prepared chalk, or lime, and arsenic mixed with any undrying oil, or tallow, or fatty compounds that do not harden by exposure to the atmosphere (or water*). The whole or either of the above compositions can be applied and used just as ordinary paint is applied, and either with or without heat.

* The words "or water" are found in the copy of the abridgment delivered by the applicant, but do not appear in the original abridgment.

Improvements in the construction of filters, and in the preparation of materials used for the purification of water. Gustav Bischof, Professor of Technical Chemistry, Andersonian University, Glasgow. June 29, 1874.—No. 2243. This invention relates to the construction of filters and preparation of materials for purifying water. In the improved construction of filters a dished bottom is provided under the ordinary perforated bottom separating it from the receptacle for the filtered water. A bent pipe leads from this dished bottom to the exterior, where it is stopped by a cock or plug; and a small hole in the bent pipe gives passage for the filtered water to the receptacle, the hole being so adjusted in size as to prevent a rush of water through the filter when a quantity is withdrawn from the receptacle. The bent pipe serves also to discharge the water used for cleaning the filter. The porous balls or slabs ordinarily used for filtering are impregnated with a solution of a salt of iron, and the ferrous oxide of iron is precipitated in their pores by impregnating them with an alkali or alkaline carbonate. This oxide becomes by exposure hydrated ferric oxide, which has a purifying effect on the water, and which may be directly mingled with the filtering materials.

Improvements in lubricating compounds. Bridget French, Rochester, Monroe, New York, U.S.A. June 29, 1874.—No. 2249. The invention consists in the combination with petroleum, or equivalent oil of paraffin, with other ingredients, also in the combination with petroleum, or equivalent oil of stearite, or soapstone, or French chalk, for the purpose of producing a lubricating compound.

Improvements in the manufacture of sugar from the cane and other sugar-yielding materials, and in apparatus used therein, partly applicable for preparing nourishment for animals. Bristow Hunt, Serle Street, Lincoln's Inn, Middlesex. (A communication from Alvaro Francisco Carlos Reynoso, chemist, Paris.) June 30, 1874.—No. 2255. This invention consists in extracting the juice of the sugar-cane by first cutting the cane in pieces by means of a knife, and in then reducing the pieces to pulp by means of a rasp, and in then submitting the pulp to the action of an ordinary press, by which the juices are separated from the pulp; or in submitting it thereto after having mixed with it lime and phosphate of lime or any other matter suitable for causing defecation, or in submitting it thereto after having boiled it.

Improvements in the manufacture of gas and fuel. Alexander Melville Clark, patent agent, Chancery Lane, Middlesex. (A communication from Charles Jenty, Paris.) June 30, 1874.—No. 2270. This invention relates to the manufacture of gas for illuminating and heating purposes from naphthalin ($C_{20}H_8$) and petroleum oil, which are absorbed by a porous body capable of yielding proto-carburetted hydrogen, and distilled in ordinary gas apparatus, the coke residue forming an excellent fuel.

Improvements in the manufacture of alum and products resulting therefrom. William Beatson, the Chemical Works, Rotherham, York. June 30, 1874.—No. 2272. This consists, first, in employing an excess of sulphuric acid so as to convert muriates (or chlorides) of soda or potash into bisulphate of soda or potash, whereby the muriates are entirely decomposed. The resulting compound is boiled with clay or shale until a neutral solution of alum is obtained, which is crystallised in the usual manner. Second. In burning the clay or shale in conjunction with small coal or fuel in a tall upright kiln; and, third, in utilising the residue of the clay or shale for making soluble silicates, hydraulic or other similar cement, and bricks or artificial stone.

NOTES AND QUERIES.

Indigo Printing.—Could you give me any information how to stiffen acid extract of indigo for block printing? I want it as stiff as possible. I have tried flour-paste, and I find the acid works on it and it goes thin in a few days. Could you suggest any better substitute? They have a knack in Lancashire of stiffening their extract that we have not in Yorkshire.—OLD SUBSCRIBER.

MEETINGS FOR THE WEEK.

- MONDAY, May 3rd.—Medical, 8.
Royal Institution, 2. General Monthly Meeting.
- TUESDAY 4th.—Civil Engineers, 8.
Zoological, 8.30.
Royal Institution, 3. Prof. Gladstone, "On Chemical Force."
- WEDNESDAY, 5th.—Society of Arts, 8.
Microscopical, 8.
- THURSDAY, 6th.—Royal Institution, 3. Prof. Seeley, "On the Fossil Forms of Flying Animals."
Chemical, 8. N. Story Maskelyne, "On Andrews site and Chalkosiderit." Walter Flight, "An Examination of the Methods for the Separation of Iron Sesquioxide, Alumina, and Phosphoric Acid." W. Ramsay, "On Sodium Ethylthiosulphate." J. Williams, "On a Milligrade Thermometric Scale."
- FRIDAY, 7th.—Royal Institution, Weekly Evening Meeting, 8. Prof. Cornu, "On the Velocity of Light," 9.
Geologists' Association, 8.
- SATURDAY, 8th.—Royal Institution, 3. The Rev. Mark Pattison, "A Chapter of University History."
Physical, 3. Mr. H. Bauermann, "On the Electric Conductivity of Anthracite Coal." Mr. W. Crookes, F.R.S., "The Radiometer."

THE CHEMICAL NEWS.

VOL. XXXI. No. 806.

RED CHALK AND RED CLAY.

By Professor A. H. CHURCH.

SOME years ago I published an analysis* of the red chalk of Hunstanton, Norfolk. The specimens which I examined more minutely were those in which the red colour, so characteristic of this variety of chalk, was exceptionally developed. In these specimens I found a high percentage of ferric oxide, with very little silica and alumina. Mr. R. C. Clapham had shown,† however, that some samples, at all events, of red chalk contained as much as 9.28 per cent of silica, with 9.6 per cent of ferric oxide and 1.42 per cent of alumina, and that these three ingredients were also present in white chalk, though in much smaller proportions.

In view of the recent discoveries as to the materials constituting the floor of the deep sea, and acting upon a suggestion made by Professor J. Morris as to the probability of some near connection between red chalk and the "red clay" of certain deep tracts of the ocean bottom, I have again studied the chemical nature of the former material; but this time I employed a different method of analysis, and I operated upon the paler and more ordinary variety of red chalk. The samples used were numerous, but the results of the treatment to which they were submitted were nearly uniform.

The following is a brief outline of the plan which was pursued in order to see if it were possible to separate from red chalk a red clay, slime, or ooze, similar to that which is reported by the officers of the *Challenger* Expedition to cover the Atlantic bed at average depths of some 2700 fathoms. Treatment with very dilute hydrochloric acid in the cold seemed the best way of removing the calcium carbonate present. This acid was allowed to act upon small crushed pieces of selected red chalk until fresh acid failed to remove any further traces of calcium. By appropriate washing in an apparatus similar to that figured in my "Laboratory Guide,"‡ the finer portion of the undissolved residue from the chalk was readily separated from the siliceous fragments which accompanied it. This finer portion remains suspended for some time when stirred up in pure water, and was found to be almost, if not quite, homogeneous; it contained no lime. It amounted, on the average, when air-dried, to 9.3 per cent of the weight of the chalk taken, but some dark samples furnished higher percentages. Its physical characters correspond, so far as I can learn, to those of the red residue obtained by Mr. Buchanan from the Globigerina ooze, and to those of the smooth red clay before referred to as brought up from the deeper parts of the sea-bottom.

The following analysis abundantly proves how closely the chemical composition of the red argillaceous residue from red chalk resembles the red clay in question:—

Analysis of Red Clay from Red Chalk.

	In 100 Parts.		
	Air-Dried.	Dried at 100° C.	Ignited.
Water	14.73	7.54	—
Silica	52.87	57.33	62.01
Ferric oxide (Fe ₂ O ₃)..	12.81	13.89	15.02
Alumina	15.65	16.97	18.36
Magnesia (MgO) ..	2.65	2.87	3.11
Potash (K ₂ O) .. .	1.33	1.45	1.56
	100.04	100.05	100.06

* 1863. *Journ. Chem. Soc.* (2), vol. i., p. 99.

† 1852. *CHEMICAL NEWS*, vol. vi., p. 313.

‡ "Laboratory Guide," 3rd edition, 1874, p. 163.

Although the above numbers clearly indicate a substance which may be fairly designated "a silicate of red oxide of iron and alumina," like the "red clay" of Professor Wyville Thomson,* it would be idle now to speculate as to the probable correspondence, in the minuter details of their composition, of the red chalk residue with the red clay of the deep Atlantic and Southern Sea. Still it may be profitable to allude to two or three points which are likely to throw light upon the relationship of the white, grey, and red chalk with the globigerina, the grey and the red ooze, respectively. First, analysis seems to show that the removal, in different degrees, of calcareous matter, however effected, has been the main cause of the differences of such formations. Secondly, it would appear that, although manganese dioxide is present in granules and nodules in the red oceanic clay and in the coarser particles of the red chalk, it is absent alike from the finely-divided substance of the former and the similar red residual slime of the latter. And, thirdly, the suggested relation between both these red matters and the mineral known as *glauconite* receives an unexpected light through the detection of sensible quantities of magnesia and potash in the red chalk residue; for the latter base is an invariable constituent, and the former an usual one of this species.

The complex and rather variable silicate which, from its grey-green hue, has received the name of glauconite, is known both in ancient and recent formations of green sand. The casts of animal forms which constitute the glauconitic grains of cretaceous greensand strata are paralleled by similar remains in the recent greensands of the Australian seas, and of those of the Agulhas current investigated by the scientific staff of H.M.S. *Challenger*. But the problem of the formation of recent greensand, or rather of glauconitic matter, at moderate depths, and of the related red clay at very great depths is not yet solved. It is by no means necessary to suppose that glauconite was always first formed, and that it yielded the red clay in question by oxidation and partial solution, just in the same way that kaolin or white clay has been produced from felspar. This has probably happened in some instances; but it may be assumed, on the other hand, that the same constituents have yielded one or other of these two products, in accordance with differences in the dissolved gases and salts of the ocean and in the nature of its prevalent animal and vegetable forms.

One step towards the discovery of an answer to the problem now under discussion might be furnished by a careful study of the action, under pressure, of water holding oxygen and carbon dioxide in solution, upon powdered glauconite. But we really stand in need of more information as to this species itself, for the composition of the numerous minerals included under this name is somewhat ill-defined. Still we may conclude that it contains, as essential constituents, silica to the extent of 50 per cent; a variable amount of alumina; much iron in the ferrous, as well as in the ferric condition; several per cents of potash; a little magnesia; and, finally, about 7 or 8 per cent of water. It would not require a very profound alteration of such a mineral to give it the composition indicated by the analysis of our red chalk residue, when dried at 100° C. Such alteration would involve peroxidation of the iron, removal of most of the potash, and relative increase of the alumina, results commonly seen in many altered mineral residues.

Great interest attaches to all questions concerning the red oceanic clay. Its minute analysis will, doubtless, solve some of the problems referred to in the present imperfect note. In the meantime, I am anxious that it should not be supposed that I ignore the differences which must subsist between recent oceanic deposits and the rocks which we may consider to have originated in former ages from similar materials. It is not that the mere process of consolidation must have altered them, but that the influences to which they have been subsequently exposed may have caused unsuspected, though not inconsiderable.

* *Proc. Roy. Soc.* vol. xxiii., pp. 39 and 45.

changes in their chemical constitution. Materials for the discussion of this question are still deficient, and we must await complete quantitative analyses of recent glauconite, and of the red oceanic clay, before a decision can be reached. On account of this insufficiency of data, I have refrained from suggesting any formula for the red chalk residue, though it may have, like kaolinite, a claim to be regarded as a mineral species.

LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE
CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.
(Continued from page 155).

LECTURE XIII.

In the preceding lectures all the cases in which a crystal can be conceived as symmetrical to a series of its planes lying in a single zone have been considered: there remain, however, those various cases to be discussed which may result from planes not belonging to the same zone being planes of symmetry. One might, for instance, put

sides are arcs of zone circles of symmetry, and since therefore the angles of such a triangle can only have crystallometric values, it becomes a very simple trigonometric problem to determine what systematic triangles are at all possible. They are—taking a, b, c for the angles, and A, B, C for the arcs opposite to them—only the following:—

	$a.$	$b.$	$c.$	$A.$	$B.$	$C.$
I.	$\begin{cases} 90 & 60 & 60 \\ 90 & 60 & 45 \end{cases}$			$\begin{matrix} 70 & 31 & 7 \\ 54 & 44 & 15 \end{matrix}$	$\begin{matrix} 54 & 44 & 15 \\ 45 & & \end{matrix}$	$\begin{matrix} 54 & 44 & 15 \\ 35 & 15 & 85 \end{matrix}$
II.	$\begin{cases} 90 & 90 & 60 \\ 90 & 90 & 30 \end{cases}$			$\begin{matrix} \frac{\pi}{2} \\ \frac{\pi}{2} \end{matrix}$	$\begin{matrix} \frac{\pi}{2} \\ \frac{\pi}{2} \end{matrix}$	$\begin{matrix} \pi \\ 3 \\ \frac{\pi}{6} \end{matrix}$
III.	$\begin{matrix} 90 & 90 & 45 \end{matrix}$			$\begin{matrix} \pi \\ 2 \end{matrix}$	$\begin{matrix} \pi \\ 2 \end{matrix}$	$\begin{matrix} \pi \\ 4 \end{matrix}$
IV.	$\begin{matrix} 90 & 90 & 90 \end{matrix}$			$\begin{matrix} \frac{\pi}{2} \\ 2 \end{matrix}$	$\begin{matrix} \frac{\pi}{2} \\ 2 \end{matrix}$	$\begin{matrix} \frac{\pi}{2} \\ 2 \end{matrix}$

In the six cases, by which we have here exhausted all the possible varieties of a systematic triangle, we recognise the last four as representing the symmetrical relations of the trigonal and hexagonal, of the tetragonal and of the orthorhombic, systems. It remains for us to consider the character of the systems resulting from the first two

FIG. 13.



questions such as these:—Suppose in a trigonal or hexagonal system that other planes of symmetry intersected with the planes S and C at crystallometric angles; or, again, suppose in the tetragonal system that the plane C were to become conformable with either the S or the Σ group of planes, in which case new planes of symmetry would intersect at 45° with the planes in question in their zone axis; and every supposition that we can frame of this kind would readily receive an answer from trigonometry. The principle of a systematic triangle that has been introduced in previous lectures enables us, however, to deal with this problem from a more general point of view.

Since the systematic triangle represents the smallest spherical triangle that any system admits of, of which the

kinds of systematic triangles. They will be severally represented by figures. But it will be seen that great circles passing through the poles h , in pairs, are potentially also planes of symmetry, and in this case the two kinds of symmetry under consideration become identical; since the zone circles $[hh]$, Fig. 14, will bisect each and every of the systematic triangles in the former of the two cases, forming new systematic triangles which fulfil the conditions of having their angles crystallometric. This condition, however, is not fulfilled by the zone circles passing through adjacent pairs of poles, d , since the spherical triangle formed by the sides dt, do, ot , in Fig. 14, has its angle at $d = 67.30$, which is not a crystallometric angle; nor are the adjacent spherical triangles repetitions by symmetry of this triangle. It results from this that the

poles o are poles of trigonal, but not of hexagonal, symmetry: the poles h , on the other hand, are tetragonal poles, and the poles d are ortho-symmetrical in character. In fact, the system under discussion presents us with three planes of symmetry, containing the zone circles, $[h h]$, perpendicular to each other, which we may call the proto-systematic planes S ; and, further, six planes of deutero-symmetry, Σ , intersecting in triads in the axes $[o]$ and in pairs perpendicularly in the axes $[h]$, in which they intersect at 45° with the great circles S , each plane Σ again meeting a plane S perpendicularly in a zone axis $[d]$. The poles h and o represent those of the well-known figure, the cubo-octahedron; the poles d are those of the rhombic-dodecahedron, or 12-faced rhombohedron. Forty-eight systematic triangles partition the surface of sphere, so that the most general form of this system—and therefore, also, the most complex single form in crystallography—is the 48-faced scalenohedron, known as the hexakis-octahedron $\{h k l\}$. The planes S are naturally axial planes of the system; they are parallel to the faces of the cube, and the crystallographic axes are their normals. A face of the octahedron intersects at equal distances with each of these axes, so that the parameters of the crystal are equal.

system are so far isomorphous. If all the permutations that can be performed on the position of the indices in the symbol $\{h k l\}$ of the hexakis-octahedron be combined with all the different varieties in sign which those indices can undergo, it will be found that a symbol will be obtained for each one of the forty-eight faces, with a determinate position on the sphere.

The characters of the several forms the poles of which lie on the arcs or at the angles of the systematic triangles were next considered, though not in detail, since their descriptions are to be obtained in any of the ordinary works on crystallography.

Taking $h > k > l$, the symbol $\{h k k\}$ was that of the 24-faced figure, the icositetrahedron; the form $\{h h l\}$ being that of the triakis-octahedron, and the form $\{h k o\}$ that of the tetrakis-hexahedron: the poles h of the cube belong to the form $\{100\}$; the poles d of the rhombic-dodecahedron to the form $\{110\}$; and the poles o of the octahedron to the parametral form $\{111\}$.

Of the merosymmetrical forms of this system, the α symmetrical kind being unexemplified in Nature, the holo-

FIG. 14.



The systematic triangle has, as we have seen, for sides—

$$H = 35^\circ 15' 35'' \quad D = 54^\circ 44' 15'' \quad O = \frac{\pi}{4},$$

and for angles—

$$h = 45^\circ \quad d = 90^\circ \quad o = 60^\circ,$$

and the axial system is represented by the expression—

$$\xi = \eta = \zeta = 90^\circ \\ 1, 1, 1,$$

wherein it will be seen that the five variable elements of the crystal are all employed in fulfilling the requisite conditions (involving one more than the tetragonal system involves, viz. this, that the planes C and S of that system are conformable), and, consequently, all crystals in this

systematic hemihedral forms, including the tetrahedron, $\kappa\{111\}$, the hexakis-tetrahedron $\kappa\{h k l\}$, the trigonal dodecahedron $\kappa\{h k k\}$, and the triakis-tetrahedron $\kappa\{l h h\}$, were alluded to. In them the S planes are only potential, while the Σ planes are actual planes of symmetry. The hemi-systematic forms—in which the planes Σ are potential, while the planes S are actual planes of symmetry—are centro-symmetrical; such are $\pi\{h k l\}$, the dyakis-dodecahedron, and $\pi\{h k o\}$, the pentagonal dodecahedron, a figure not to be confounded with the regular dodecahedron of geometry. A tetartohedral form exists in this system, the dyakis-hexahedron $\kappa\pi\{h k l\}$, consisting of twelve irregular pentagons. It

is remarkable, in this respect, that the crystals which carry it as a form exhibit rotatory polarisation similar to that exhibited by quartz.

ERRATA.—P. 64, col. 2, lines 13 and 14 should read as follows:—"symmetrical to S, and potentially to a plane of which n is the pole. So m and n are possible planes, and, on the assumption of," &c. P. 102, col. 2, line 14 from bottom, *for its read each*. P. 102, col. 2, line 10 from bottom, *for signs read sides*. P. 111, col. 2, line 7 from bottom, *for c read C*.

ON THE OCCURRENCE OF PHOSPHATES IN THE CAMBRIAN ROCKS.*

By HENRY HICKS, F.G.S.

IN this paper the author showed from experiments that the Cambrian strata in Wales contain a far greater amount of phosphate and carbonate of lime than had hitherto been supposed. The results published by Dr. Daubeny some years ago, and which have since received the support of some eminent geologists, were proved therefore to be entirely fallacious when taken to represent the whole Cambrian series; for though some portions show only a trace of these ingredients, there are other beds both interstratified with and underlying these series, which contain them in unusually large proportions. The author, therefore, objects to look upon Dr. Daubeny's experiments as tending in any way to prove that the seas in which these deposits had accumulated contain but little animal life, and that we had here approached the borders of the lower limit of organic existence. He contended that the presence of so much phosphate of lime; and also of carbonate of lime, as was now proved by analyses made by Mr. Hudleston, F.C.S., Mr. Hughes, F.C.S., and himself, to be present in series of considerable thickness in the Longmynd group, Menevian group, and Tremadoc group, proved that animal life did exist in abundance in these early seas, and that even here it must be considered that we were far from the beginning of organic existence. The amount of phosphate of lime in some of the beds was in the proportion of nearly 10 per cent, and of carbonate of lime over 40 per cent. The proportion of phosphate of lime, therefore, is greater than is found in most of what have been considered the richest of recent formations. The amount of P_2O_5 was also found to increase in proportion to the richness of the deposit in organic remains. It was found that all animal and vegetable life had contained it from the very earliest time; but it was apparent that the Crustacea were the chief producers of it in the early seas; and of the Crustacea, the trilobites more particularly. It was always found where they were present, and the shell of some of the larger trilobites, as now preserved, contain as much as from 40 to 50 per cent of phosphate of lime. The analyses made by Mr. Hudleston and the author of recent Crustacea proved that they also contain P_2O_5 in very considerable proportions.

In the second part of the paper the author showed that where intrusive dykes had passed through or between the beds containing the phosphate of lime, the beds for some distance on each side of the dykes had undergone a considerable change. Scarcely a trace of the P_2O_5 or of the lime was now to be found in them, though it was evident that before the intrusions into them had taken place, they, like the other portions of the beds, had evidently contained both ingredients in considerable proportions. It was well known that heat alone could not separate P_2O_5 from lime; therefore he found it difficult to account for this change in the character of the beds, unless it could be produced by gases or watery vapour passing into them at the time the intrusions took place. He thought it even probable

that the dykes, which in some parts are found to contain a considerable amount of lime and also P_2O_5 , might have derived these, or at least some portions of these, from the beds through which they had been forced, and which must have been broken up and melted as they passed through them. There are no contemporaneous tuffs known in Wales of earlier date than the Llandeilo beds; and he thought these dykes belonged to that period, and that they were injected into the Lower Cambrian beds after from 8,000 to 10,000 feet of deposit had been superimposed. In an agricultural point of view the author considered that the presence of so much phosphate of lime in some of the series of beds must be a matter of great importance; and on examining the districts where these series occurred, he invariably found the land exceedingly rich.

Mr. Hudleston gave the results of the analyses made by him at the request of Mr. Hicks. He found in a portion of dark grey flaggy rock taken from close to a fossil r.62, in a portion of black slaty rock containing trilobites, but in contact with trap o.11, in a portion of the shell of a trilobite 17.05, and in the trap above mentioned 0.323 per cent of phosphoric anhydride. A lobster-shell dried at 100° C. gave 3.26, an entire boiled lobster (undried) 0.76, and a boiled lobster without shell 0.332 per cent of P_2O_5 . If the analysis of an entire lobster be correct, he estimated that a ton of boiled lobsters would contain about 17 lbs. of phosphoric anhydride. In the analysis of the shell of a trilobite there appears to be a great excess of phosphoric acid, which Mr. Hudleston thought must be due to substitution.

Prof. MASKELYNE said that the solution of the question of the diminution of the phosphate of lime near intrusive rock was easy. The intrusive rock in cooling would contract, and thus facilitate the percolation from above or the forcing up from below of water, which flowing through the adjacent rocks would dissolve out the phosphate of lime. He remarked that north of Cardigan Bay pisolitic iron ore was found charged with phosphate of lime.

Mr. D. FORBES stated that when, many years ago, Dr. Daubeny maintained that the Cambrian rocks only contained mere traces of phosphoric acid, he had published (in 1857) chemical analyses of some of the oldest then known limestones, showing that these contained quite as much phosphoric acid as recent ones. He considered that the larger proportion of phosphate of lime found in the fossil Crustacea, as compared to the recent, was mainly due to the fact that, besides the organic matter, carbonate of lime had also been removed from them; and that the reason of the casts of *Paradoxides* near dykes of igneous rock containing only traces of phosphoric acid and lime was rather the removal of these substances by water than the igneous action of the dyke. He could not agree in believing that the phosphoric acid found in eruptive rocks was derived from the sedimentary fossiliferous beds through which they passed, but regarded it as an inherent constituent of the eruptive rock itself. Even the Menevian and Laurentian rocks were after all only made up of the *débris* of previous eruptive rocks; and he looked upon the eruptive rocks as the original source of all the phosphoric acid assimilated by animal and vegetable life. He regarded this paper as a most valuable contribution to geological science.

Mr. KOCU enquired whether any Vivianite had been obtained by Mr. Hicks.

Prof. SEELEY thought that the paper, interesting as it was, did not bring us any nearer to the source of the phosphate of lime in phosphatic deposits, especially such as those recently described by Mr. Davies as occurring in the Bala beds. The proportion of phosphoric acid in the ash of the lobster did not appear to be greater than in that of plants; and whilst the *debris* of marine animals would be rapidly dispersed, those of seaweeds would remain at the bottom, and it was to these that he was inclined to attribute the accumulation of phosphate of

* A Paper read before the Geological Society of London, March 24, 1875.

lime in these deposits. At the same time he believed that the phosphoric acid was primarily derived from volcanic rocks, out of which the phosphates have been washed by water. The great proportion of phosphate of lime in the shell of the trilobite was probably due to infiltration.

Mr. HUGHES said that he had examined many soils in Australia and elsewhere, and that when the soil was deficient in phosphate of lime the underlying rock was the same, but when the soil was rich in phosphate the rock also contained it. He had also found phosphoric acid in igneous rocks from the north of England and Scotland.

Mr. TOPLEY enquired as to the amount of phosphoric acid in the flesh of the lobster. He remarked that the shells of the gault were largely phosphatised, and that they seem to have drawn their phosphoric acid from the surrounding rock. There are many phosphatic nodules in the lower part of the gault, and also on the surface of the Kentish rag.

The AUTHOR, in reply, said he thought it possible that water, or rather watery vapour, may have washed out the phosphate of lime from the altered beds; but he contended that this must have taken place at the time the intrusions occurred, for at present these beds are as solid and impervious to water as are the beds in which the phosphate of lime is now present. He stated that he did not intend to say that there were no contemporaneous traps of so old a date as the Menevian beds, but that there were none in Wales of earlier date than the Arenig or Llandeilo series; he had even mentioned that there were some in Canada of the age of the Laurentian rocks; but as there was no evidence of any of these in Wales, we could not look upon the phosphate of lime in these beds as having been obtained from dissolved apatite. In reply to Prof. Seeley, he said he could not allow that some beds lost all their phosphate of lime by percolation of water, and that the fossils in the others obtained it by the same means. He did not suppose, however, that all the phosphate of lime present in the fossil shell occurred in the natural shell, and he believed that it had to some extent in the process of fossilisation replaced carbonate of lime.

Mr. HUDLESTON, in reply to Mr. Topley first, said that his calculations of the percentage of phosphoric acid in the lobster were based upon the amount compared with the total contents of the animal itself, as this seemed the most suitable for purposes of geological inquiry. That ratio once established, other calculations might be made. The phosphates in these as in other sedimentary rocks must be regarded as a sort of residuum or ash, the result of the decomposition of nitrogenous organic matter which was left after the more volatile carbon, hydrogen, nitrogen, and oxygen had, under various combinations, more or less completely disappeared. Calcium phosphate is known to be the chief constituent of the ash of most albuminous principles; analyses of these were quoted. The question of the loss of phosphoric acid in the rock adjoining the trap was one of much difficulty; but as an instance somewhat similar, Bischof was quoted to the effect that large quantities of calcium phosphate occur in basalt in the vicinity of a guano deposit at the Isle of Ascension.

THE COKE-MANGANESE GALVANIC CELL.

By SERGIUS KERN, St. Petersburg.

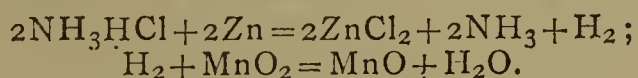
THE well-known Leclanché's cell is now in use for many purposes, giving a very constant current, but which, however, is much decreased by the resistance of the tar covering the top of the porous cell, and by the decomposition of the manganese dioxide, which is transformed during the action of the cell into manganous oxide; the latter oxide closes the pores of the cell. My cell is a modification of Leclanché's one, and the experiments proved it to act very constantly.

Two parts of cleanly washed coke, and one part of

manganese dioxide (MnO_2) in the state of powder, are well mixed together with a small quantity of water acidulated with some drops of nitric acid; the mixture then is strongly pressed into brown paper cartridges 0.125 metre high and 0.03 metre diameter. The resulting coke-manganese cylinders are dried in a warm place, but not over a fire, because the heat, as it is known, decomposes the manganese dioxide.

The dried cylinders are placed in glass jars containing concentrated solution of ammonium chloride (NH_4HCl), and surrounded with zinc-plates curved in the usual manner. By this arrangement the use of porous cells is avoided, and a battery of such elements acts more constantly; besides this, the construction of it is cheaper. Instead of having glass jars, I am using wooden boxes, the size of the glass jars; the internal parts of the boxes are covered with the following mixture, melted in an iron cup:—2 parts of wax, 10 parts of common resin (colophony), 2 parts of red-lead, and $\frac{1}{8}$ part of gypsum.

The zinc of the element is the negative pole; the coke, the positive pole. The reactions which take place in this element may be represented by the following equations:—



REPORT

ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

The Elements of Water.† By Dr. A. OPPENHEIM.

Oxygen.—Like the evolution of human life, the development of every chemical art is connected with oxygen; Directly or indirectly, it intervenes in every manufacturing operation. With equal necessity, life and technology derive it from that exhaustless source of all being, the atmosphere. Furthermore, no discovery has had a greater significance for the history of culture than that of the material nature of the air, and the discovery—the centenary of which we commemorate this year—of its most important constituent, oxygen gas.‡ To the same discoveries chemical industry owes its rational foundation and the possibility of its advancement, and thus both the existence and the progress of technology are linked to the same element. What, in comparison with these incalculable benefits, are the advantages which pure oxygen gas has conferred upon industry by its direct application? To give a reply to this question is the object of the following lines, and as no reports or text-books have hitherto treated this subject in a connected manner, we may venture to exceed in point of time the boundaries of this report.

Lavoisier, who first recognised in its full extent the importance of oxygen, took the first successful step in its technical application. "It is evident," he writes,|| "that atmospheric air is not the most suitable to increase the action of fire, and that, if we drive a current of air upon ignited fuel by means of bellows, three parts of injurious, or at least useless, gas are driven in for one part of the serviceable kind of air, and that, therefore, if the latter could be used for combustion in a pure state, the action of the fire would be much enhanced. This idea has doubtless occurred to many persons prior to myself, and I

* "Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends."

† "Die Elemente des Wassers."

‡ "On the 1st of August, 1774, I endeavoured to extract air from mercurius præcipitatus per se."—Joseph Priestley, "Experiments and Observations on Air," ii., 106. See also Kopp, "Geschichte der Chemie," iii., 200 and 204.

|| "Memoire sur un Moyen d'Augmenter Considérablement l'Action du Feu et de la Chaleur dans les Operations Chimiques."—"Oeuvres de Lavoisier" ii., 425.

hear that Archard, the celebrated chemist of Berlin, has carried it into application;* but it is still needful to devise a cheap and convenient apparatus."

For this purpose, Lavoisier used at first bladders fitted with tubes and taps. "I made," he continues, "with a knife, a hole three to four lines deep in a large piece of charcoal, and laid in it 6 grs. of platinum, set fire to the charcoal at an enameller's lamp by means of a blowpipe, opened the jet of my apparatus, and blew pure oxygen into the hollow. The charcoal burnt very rapidly, with detonation as it produces with melted saltpetre, and with a dazzling brilliance; and in a few moments the platinum melted into granules, which then united into a ball. The fusion was equally successful, whether the ordinary platinum of commerce was taken or such as had been previously freed from magnetic particles by means of a magnet. Hitherto, platinum has not been melted."

Lavoisier improved his apparatus in the same year,† in conjunction with Meusnier, and produced a gasometer consisting of two boxes, and which on a small scale much resembled those now in use at gas-works. About the same time, Saron constructed two blowpipes (*chalumeaux*), one of which delivered oxygen and the other hydrogen. By their means, however, Lavoisier did not succeed in fusing platinum.‡ He hoped, however, to construct an improved blowpipe, in which the oxygen should surround the hydrogen, and thus was developed the plan of the oxyhydrogen blowpipe, which has rendered such essential service in the metallurgy of platinum and in soldering lead.

The application of oxygen for melting platinum remained dormant until, in 1857 to 1859, Deville and Debray made known their important investigations§ on the platinum metals, and introduced the industrial fusion of platinum. The autogenous soldering of platinum, and the production of fused ingots on the large scale, was first carried out by Johnson, Matthey, and Co., of London, and also by Heraeus, of Hanau, in Germany.

Debray's and Deville's experiments led, above all, to the discovery of a refractory material for crucibles and furnaces. For this purpose quick-lime offered itself, which has the further advantage of retaining the heat as completely as possible. The chemists above-named increased the heat further by leading the flame from above directly upon the surface of the metal, and determined the amounts of oxygen and hydrogen theoretically and practically necessary for melting 2 kilos. of platinum, *i.e.*, by calculation, 55 litres of oxygen and 110 of hydrogen. The amount actually fused was more than 1 kilo, so that—a highly favourable result—not 50 per cent of the heat produced was wasted. These experiments had a further bearing upon the industrial history of oxygen, as they led to the comparison of the cost of the methods of its production and to the search for a less expensive process. We may divide the known methods into chemical and mechanical, subdividing the former into continuous and interrupted procedures.

(To be continued.)

Inaccuracy of Determinations of Nitrogen in Manures.—A. Bobierre.—The author shows that in the analysis of oil-cake, a smaller or larger portion of the ammonia liberated may be dissociated, according to the conditions under which the combustion is carried on. The losses may amount to 24 per cent of the total nitrogen in the sample. To avoid them it is necessary not to use too long a combustion-tube, to employ a gas- instead of a charcoal-furnace, and to conduct the operation rapidly. —*Comptes Rendus*.

* *Memoiren der Berliner Academie*, 1779. "Sur un Nouveau Moyen de Produire avec une tres Petite Quantite de Charbons une Chaleur," &c.

† Lavoisier, "Oeuvres," ii., 432.

‡ Lavoisier, "Oeuvres," ii., 430.

§ Deville and Debray, 1859, *Ann. Chim. Phys.*, lvi., 385. *Dingler's Polyt. Journ.*, cliv., 130, 199, 287, 383.

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

ON Wednesday last, the 5th inst., an ordinary general meeting of the Society was held at Cannon Street Hotel. The President (Dr. REDWOOD) was in the chair, and the meeting was numerously attended by members from various parts of the country.

The minutes of the last meeting having been read and confirmed, Mr. WIGNER (Joint Secretary) read the following report of the Council:—

TO THE SOCIETY OF PUBLIC ANALYSTS.

GENTLEMEN,—The Council beg to present a Report of the steps they have taken since our last meeting, on February 5th, in reference to the proposed repeal of the "Adulteration Act, 1872," and to the "Sale of Food and Drugs Act, 1875." At that date it will be remembered that, though an intimation had been given of the probable introduction of a new Adulteration Bill, the draft of such Bill was not printed, and its provisions were therefore entirely unknown. Considering it desirable, however, that the views of this Society should, if possible, be embodied in the Bill on its first seeing the light, rather than in subsequent amendments, we addressed a letter to the Secretary of the Local Government Board, requesting him to receive a deputation for the purpose of hearing certain representations which we were prepared to make, as to some features which we considered it important should appear in the new Bill. For convenience, we classified the points referred to under thirteen heads. To this letter we received a most courteous reply from Mr. Clare Read, conveying the thanks of the President of the Local Government Board for the suggestions we had offered, and expressing his hope that many of them would be found to be met in the forthcoming Bill, of which Mr. Read promised to send us an early copy. Agreeably with this promise Mr. Read forwarded to us, on the 16th of February, a draft of the "Sale of Food and Drugs Bill."

Seeing at once the urgency of our immediately taking this Bill into our consideration, the Secretaries summoned a Council meeting by telegraph, for February 18th. At this meeting, which was a protracted one, the Bill was debated clause by clause, and, as a result, the Secretaries were instructed to urge upon the Government—either orally or by letter, or by both means—certain amendments in the Bill, which appeared to the Council to be of vital importance. Conformably with this instruction the Hon. Secretaries sought and obtained an interview with Mr. Read on the following day, being the date fixed for the second reading, when various points were urged upon him. To the reasonableness of some of these amendments he at once assented, and promised a full consideration to the whole of them. The Secretaries, not being content to rely wholly upon Government support, had an interview with Dr. Lyon Playfair, who went at great length and with much interest into the matter, and whose speech on the second reading displayed an ability and a comprehensive grasp of the subject unapproached by any other speaker.

A further Council meeting was held on March 2nd, when Mr. Wigner submitted a form of certificate as an amendment to the one printed in the Schedule of the Bill. This was unanimously adopted, and the Secretaries requested to transmit a copy of the same to the Local Government Board, together with some further suggestions for amending the Bill.

The Bill being now fairly before the public, articles appeared in many of the newspapers severely criticising its provisions. Amongst others the *Times* published a very able article on the subject, which, however, contained what appeared to be a reflection on the Public Analysts,

and to which, therefore, our Secretaries felt it their duty to reply. Their letter, which appeared on the 25th of February, formed the subject of a further leader in the *Times*, and was also extensively copied and commented upon by various other London papers. The views of the Council, besides being ably advocated by the *Lancet* and other medical and chemical papers, were put forth and explained week by week in the CHEMICAL NEWS, a paper which, it has been gratifying to find, has come to be referred to—by Members of Parliament and others—as an authority on the question.

The Bill was put down for Committee for March 4th, but was only committed *pro forma*, for the purpose of its being reprinted. It was shortly afterwards issued in its revised form, when it was noticeable that—though still a very imperfect measure—many of the blemishes to which we had called special attention had been removed. Our definition of “food” was inserted in place of the one originally given. The words “knowingly” and “usages of trade,” to which we had offered the most strenuous objection, were found—the latter entirely, and the former in several cases—to have been expunged from the Bill. The labelling clause was amended in accordance with our suggestion, a provision being inserted to ensure distinctness and legibility. One most important matter—which had been wholly unprovided for in the original Bill—the Government had, in the amended Act, made provision for, namely, the punishment of the wholesale dealer, on the strength of whose false warranty the retailer would have escaped punishment for selling adulterated articles. In numerous other minor points, too, it was evident that the Local Government Board had not only considered our suggestions, but adopted them.

The Bill being fixed for Committee on March 19th, the Secretaries again wrote to Mr. Read, reiterating their objections to certain clauses in the Bill, and pointing out other defects to which notice had not already been drawn. They also addressed other Members of Parliament known to be alive to the importance of the purity of the food supply, and received gratifying expressions of support. To Dr. Cameron, one of the Members for Glasgow, the Council have to express their special obligation for the great interest he manifested in the question, and for the valuable amendments he has placed on the paper.

The Bill did not (from pressure of other business) come before the House on the day fixed, nor did it on April 5th, when it was again on the paper,—on which date the Secretaries addressed another note to the Local Government Board, but on one point only. It has all along been the opinion of the Council that the proposed reference of disputed cases to the Laboratory at Somerset House was objectionable in the highest degree, and would be fraught with injustice to Analysts of standing and reputation; but so strong was the party advocating this, that the Council almost despaired of maintaining their opposition. When, however, Sir Henry W. Peek (who is supposed to specially and directly represent the grocery trade) gave notice of an amendment to the effect that the Somerset House certificate should be considered *final*, it became obvious that a strong protest must be made to prevent as gross a piece of injustice as could be imagined. It was therefore pointed out to Mr. Clare Read that whoever made an analysis for the purpose of verifying or disproving the correctness of a previous analysis, whether he was in Somerset House or not, should be compelled, if necessary, to verify his analysis on oath; and that, without such a stipulation, the character of an Analyst—no matter how high his standing or how great his attainments—would be utterly at the mercy of some Government subordinate, who would be irresponsible, and *might* also be incompetent. The President and Secretary of the Local Government Board wrote, thanking us for our letter; but as the clause in question has not yet been reached in Committee, it remains to be seen what action will be taken in reference to the matter in question.

At length, after various postponements, the Bill was

partially considered in Committee on the 20th of April; but it came on very late, and but little progress was made, only the fifth clause being reached. Clause 2 was altered so as to take “water out of the definition of “food,” thus laying it down clearly that no Public Analyst can be called upon to analyse water under the new Act. This is an improvement, as in some districts it has been considered a part of the Analyst’s duty to examine the water supply. In Clause 3 another of the remaining “knowinglys” has been eliminated, and this (in view of securing convictions) is extremely important. In Clauses 4 and 5 there have been slight changes in the phraseology, in each case for the better.

In addition to the voluminous correspondence which has passed between the Secretaries, the Local Government Board, and various Members of Parliament, and the numerous interviews they have had with members of the Government and others, we must mention that the President of the Society (Dr. Redwood) and one of the Vice-Presidents (Mr. Wanklyn) waited upon Mr. Slater-Booth, and laid before him very fully their views on the proposed Somerset House scheme.

NUMEROUS remarks were made, and questions asked, as to the amendments of the Bill which at present stand on the notice paper of the House of Commons, and were duly replied to by Members of the Council. After a full discussion the report was unanimously approved.

Scrutineers were appointed to examine the voting papers sent in by the members, and reported as the result that the following gentlemen had been elected:—

As an Honorary Member—R. Angus Smith, Ph.D., F.R.S., F.C.S., &c., Manchester.

As Members—M. A. Adams, F.R.C.S., Maidstone; A. H. Church, M.A. (Oxon), Cirencester; V. Cruse, F.C.S. Ipswich; Wm. Edward Porter, F.C.S., Worcester; B. H. Paul, Ph.D., London.

As Associates—F. J. Lloyd; S. J. Weston.

The following paper was then read by the AUTHOR:—

ON AN EASY METHOD OF TAKING THE MELTING-POINT OF BUTTER AND OTHER FATS.

By JOHN WILLIAM TRIPE, M.D.,
Medical Officer of Health, and Analyst for the Hackney District.

HAVING been much dissatisfied, nearly twelve months since, with the methods then in use for taking the temperature at which butter and other solid fats melt, I tried several plans, but without success. It struck me, after a time, that advantage might be taken of the difference between the specific gravity of the fat and the water in which it is melted, and I therefore cut some tubing—having a bore of about $\frac{1}{8}$ th of an inch in diameter—into lengths of $4\frac{1}{2}$ inches, rather more than half filled them with the fat to be tested, and, after labelling them, put them aside to cool. I then selected a beaker which fitted sufficiently closely to an opening in the water-bath, and, filling it with water at 65°, dropped it into the opening, so as to allow the beaker to be kept suspended by its rim in the water contained in the bath. The tubes, which were open at both ends, were then placed in the beaker, with a delicate thermometer, and a small gas-burner placed below the water-bath, so as to raise the temperature of the contained water very slowly. As the fat melted in the tubes it rose up, in consequence of the water entering at the lower end, and the temperature at which it rose was read from a thermometer placed with them in the beaker. The experiment was very satisfactory, as its repetition with the same fat gave the same temperature in all cases within a degree, and generally within a smaller range.

Simple as the process is, certain precautions must be adopted to make it successful. Some of these are incident to all methods of taking the temperature of the melting-point of fats, such as previously drying and cla-

rifying the fat to be tested, so that we melt the pure fat only. Others are those peculiar to the plan to be used, and I therefore proceed to point them out very briefly:—

In the first place, the tubing should have an uniform calibre, otherwise it will necessitate a more perfect melting of the fat before it rises in the tube: if the tube is to be stood upright in the beaker, which is the best position for it, the end of the tube to be placed in the water should be slightly uneven or notched, so as to allow of the free ingress of water; the tube should also be long enough to stand at least $\frac{1}{2}$ an inch above the rim of the beaker, so as to admit of its ready removal. It is better to place the finger on the end of the tube, and take it out of the water immediately the fat is melted, than to allow it to remain there and distract attention from other samples. The object of placing the finger on the end of the tube, before taking it out, is to prevent the fat from running out of the lower end into the water.

Before filling the tubes, care must be taken to have them perfectly dry and clean, and, if the laboratory should be cold, it is better to have them warmed to about 65° or 70° F., so as not to set the fat too quickly. Indeed, if the fat of mutton suet is to be tested, a higher temperature is advisable. A plug should also be made to fit that end of the tube which is to be placed in water, so that when the fat has been drawn in to the requisite height the finger may be put over the upper and the plug into the lower end, so as to prevent the melted fat running out. It is also advisable to keep the tube upright until the fat is quite cold, in which case it will stand on the end of the plug. Before taking the melting-point the plug must, of course, be taken out, if not previously removed, which it is always better to do as soon as the fat is cold and firmly set. Care should also always be taken not to test for the melting-point until perfect solidification has occurred. The height to which the tube should be filled will depend partly on the depth of the beaker, as in no case should the upper part of the fat be above the level of the water in which it is to be placed; indeed it is better that it should be at least $\frac{1}{4}$ of an inch below the top of the water. The size of the interior of the tube is also of some importance, as, if the bore be less than $\frac{1}{16}$ th or more than $\frac{1}{8}$ th of an inch in diameter, the results will not be so reliable, because, when larger tubes are used, the fat—when cold—very often will not be in contact everywhere with the sides of the glass, and especially if mutton or beef suet be tested. Thin tubing is decidedly preferable to thick. It is also advisable that a thermometer should be placed in the water-bath, so that you may prevent the temperature of the contained water rising too high and too rapidly, because when the water in the beaker approaches nearly to the melting-point great care has to be used, otherwise too high a temperature will be recorded, owing to the time occupied by the rising of the fat in the tube. For convenience in use, I have had a copper disc made of the diameter of the beaker, with holes punched around the circumference as a stand for the tubes, and another hole in the centre for the thermometer. The disc is suspended in the beaker at about $\frac{3}{4}$ of an inch from the top, and at least $\frac{1}{4}$ of an inch below the surface of the water, by means of three narrow slips of copper, which are bent over the upper edge of the beaker, so that the tubes can be kept upright during the experiment, and the rising of the fat more readily seen. The advantages of this plan are—the uniformity of the results, the ease with which the experiment can be performed, and the simplicity and cheapness of the apparatus. As to the uniformity of the results it is evident that—as the fat rises in the tube as soon as the film in contact with the glass is melted—with due care there should be no variation. There certainly is room for debate as to whether or not the water rushes in and elevates the fat before the true melting-point has been attained,—or even, on the contrary, whether the elevation is not delayed, by adhesion to the tube, beyond the true melting-point: but it is quite clear that the temperature at which it will rise must at all times be nearly the same.

In connection with this I would insist on the necessity of perfectly drying and clarifying the fat, as I have found as much difference as 8° F. in the melting-point of the same butter before and after drying, as, of course, the greater the quantity of water in the butter, the lower will be the melting-point. As regards the ease with which it can be performed, it is obvious that any one who has had the smallest amount of laboratory practice can fill the tubes to the requisite height, especially if a mark be made on the side, and also attend to the other details. The only difficulty is to record the temperatures when you have several samples in the water and are using too much heat, as the fat will then rise in one tube after another so rapidly as to necessitate having one person to note down the temperatures and another to call them out. As to the cheapness and simplicity of the apparatus, I need not make any remark, as every one has all the articles required ready at hand.

CORRESPONDENCE.

CORRECTION.

To the Editor of the Chemical News.

SIR,—I will feel much obliged if you will permit me to correct an error contained in a review of my book, "Cholera; How to Prevent and Resist it," which appeared in CHEMICAL NEWS, vol. xxxi., p. 139. A quotation from the book is there given (p. 139, col. 2, l. 29), stating that "a compact sandstone suitable for building purposes will, in a short time, absorb *from five to six times its own weight* of water." This should be "from five to six per cent," which makes a vast difference, but still is a sufficient quantity to illustrate the porosity, *i.e.*, permeability to air, of a much used building material. I must apologise for this tardy correction, but I did not see the review until to-day.—I am, &c.,

THOMAS WHITESIDE HIME.

217, Glossop Road, Sheffield,
April 28, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 13, April 5, 1875.

Singular Case of Magnetisation.—M. J. Jamin.—A magnet, described in a letter from Galileo to Curzio Picchena, had the property of attracting one and the same pole of a bar of steel when at a distance, and of repelling it when near, whilst it attracted soft iron at any distance. The author has met with a similar case.

Limit of the Carburation of Iron.—M. Boussingault.—The author holds that in carburetted iron in fusion the total carbon is in combination with the metal, and that whilst it is cooling a part of the carbon is set at liberty. If the solidification is rapid, graphite is not separated out.

Quantities of Magnetism, and on the Position of the Poles in Slender Needles.—M. E. Bouty.—Not suitable for abstraction.

Physical Properties of Plates of Collodion.—M. E. Gripon.—This membrane reflects light like glass, and polarises it both by reflection and transmission. Its index of refraction is $n = 1.5108$. It transmits a very large proportion of radiant heat, for the study of which it is better adapted than mica.

Formation of Iodic Acid in Iodised Flames.—M. G. Salet.—Iodine volatilised in the flame of hydrogen colours the oxidising region of the flame green, and gives a peculiar spectrum, which is characteristic of this element, but which, it seems, ought not to be attributed to it in the free state. The author has succeeded in demonstrating the presence of a notable amount of iodic acid. This acid, though it begins to decompose at 300°, can therefore be formed at much higher temperatures under the influence of the active oxygen present in the oxidising zone of flames.

Substitution of Mercury for Hydrogen in Creatin.—M. R. Engel.—Not suited for abstraction.

Inequality of Action of Various Isomorphs upon the same Supersaturated Solution.—M. Lecoq de Boisbaudran.—Chrome alum does not appear to dissolve in an appreciable manner in a simply saturated solution of alumino-ammoniacal alum (basic solution). Chrome alum does not dissolve appreciably in such a solution dilute enough to corrode slowly crystals of ammonia-alumina alum, which, moreover, is less soluble than chrome alum. Chrome alum does not grow on its octahedral faces in a solution which is still able to deposit alumina-ammonia alum upon the octahedral faces of this latter salt. The actions upon a solution of two isomorphs, having the same chemical functions, and being geometrically equal, are not identical.

New Procedure for Freeing the Salt Marshes of Southern France from Salt.—M. A. Joannon.—An account of certain agricultural experiments performed at Tournebelle.

Manganiferous Cast-Iron.—MM. Troost and Hautefeuille.—The presence of manganese in cast-iron greatly augments the solubility of hydrogen in the metal, and lessens or destroys that of carbonic oxide.

Carbon of White Cast-Iron.—MM. P. Schützenberger and A. Bourgeois.—Many physiologists admit that carbon set free during the decomposition of the green parts of plants under the influence of solar light unites in the nascent state with water, forming a hydrate of carbon. From this primordial hydrate they derive, by ulterior transformations, the numerous organic compounds of the vegetable kingdom. This theory would find a solid base if it were possible to isolate the carbon of any compound by a reaction at a low temperature, and to establish in this case the formation of a hydrate of carbon. White cast-iron seems very suitable for experiments of this nature. The authors treated a quantity of it in coarse powder with a solution of sulphate of copper, as in Ullgren's process for the determination of carbon. The carboniferous copper which remains is washed, and treated in the cold with a moderately concentrated solution of perchloride of iron, mixed with hydrochloric acid. The copper dissolves rapidly, and there remains a black-brown powder of small bulk, which, after washing with hydrochloric acid and water, and drying at 100°, yielded on analysis—

Carbon	64.00
Water	26.10
Siliceous ash	8.10
Matters not determined	1.80
	<hr/>
	100.00

100 grms. of the same cast-iron yielded by our method 7.135 of the black, dry residue. The weight of the crystalline graphite amounted to 1.2 per cent of the carbonaceous residue, and the determination of the combined carbon by Boussingault's method shows 63.1 of carbon for the same residue. The sum of the graphite and the combined carbon is 64.3, a number approaching very near to that (64) furnished by combustion. We may therefore admit, deducting the silicon and other impurities, that the carbonaceous residue is a hydrate of carbon. If heated to 250° it quickly loses its water without swelling.

Central-Blatt für Agrikultur Chemie,
Heft 1, January, 1875.

Formation of Ozone during the Decomposition and Formation of Water.—Prof. Böttger.—The author proves that not merely on the decomposition of water, but on its formation by the union of the purest oxygen and hydrogen, determinable quantities of ozone are generated.

Influence of Forests upon the Rainfall of a Country.—L. Fautrat and A. Sartiaux.—The authors conclude that the rainfall is greater over well wooded than over cleared districts.

Amount of Water in Walls, and on its Quantitative Determination.—Dr. Jos. Glässen.—The author, though his researches are not yet complete, holds that a house should not be inhabited so long as the moisture exceeds 1 per cent.

Influence of the Chemical Constitution of a Soil upon the Growth of the Chestnut.—P. Fliche and L. Grandeau.—The chestnut is a silica plant, but absorbs also a considerable amount of lime.

Newly Discovered Beds of Phosphorite in Austria.—S. Pick and Meusel.—The newly-found deposit occurs in Schwarzenthal, near Johannisbad, in Bohemia. Its average composition is—

Phosphate of lime	66.79
Phosphate of iron	6.27
Manganese peroxide	4.83
Carbonate of lime	8.54
Fluor calcium	5.26
Silica	5.46

Influence of Sampling Manures upon the Results of Analysis.—J. A. Barral and R. Duval.—The authors point out the difficulty of securing a fair average sample of cargos of guano.

Account of an Experiment on Oats with different Manures.—Bultman.—The highest result in money value was produced by Peruvian guano, and the lowest by Liernür's fœcal manure.

Sub-Soil Manuring.—W. Funke.—This process is recommended for lands which have become crop-sick.

Manufacture of Fœcal Manures at Graz.—J. Moser.—The process employed is precipitation with phosphate of alumina (Forbes and Price's patent).

Influence of Muscular Exertion on the Secretion of Urea.—F. Schenck and Nencki.—The authors deny that the amount of urea is increased by muscular exertion.

Peptones, and Nutrition thereby.—P. Plosz.—The author concludes from his experiments that peptones contribute to the formation of tissue.

Utilisation of One and the Same Fodder by Individuals of Equal Age and Identical Race.—Dr. H. Weiske.

Ratio of Milk to Butter.—Dr. Axmann.—The individuality of an animal has more influence than its race on the yield of milk and of butter.

Fattening Oxen, Swine, and Geese.—M. Eggers-Gorow.

Ferments in Bees, in Bee-Bread, and in Pollen, and on Certain Ingredients of Honey.—Prof. Erlenmeyer and Dr. von Planta.—The heads, bodies, and abdomens of 152 working bees were extracted with equal proportions of glycerin. The extract of the head inverted cane-sugar in twelve hours; that of the abdomen in seventy-two hours. Both converted starch into dextrin and sugar. The extract of the thorax had a much slower action. Blood-fibrin was dissolved most quickly by the extract of the abdomen, and scarcely, if at all, by that of the thorax. A glyceric extract of bee-bread, and the fresh pollen of the Scotch fir had the same effect.

Two New Foods.—Dr. E. Kern.—An examination of fibrin biscuits for dogs, and of meal for poultry.

Hybernal Colouration of the Green Parts of Plants.—G. Krauss.

Formation of Gum in Fruit Trees as a Pathological Phenomena.—E. Prillieux.—An extract from the *Comptes Rendus*, p. 1190, 1874.

Presence of Large Quantities of Nitrogen in Two Varieties of *Amaranthus*.—A. Boutin.—*Amaranthus ruber*, dried at 100°, yielded 16 per cent nitrate of potash. *A. atropurpureus* contained as much as 22.77 per cent.

Glucoses in Rye- and Wheat-Flour.—A. Pœhl.—The author shows that glucose does not pre-exist in these grains, but is formed under certain conditions, one of which is the presence of water.

Composition of Potatoes.—Dr. O. Abesser.—It is well known that Balling drew up tables deducing the amount of dry matter in potatoes, and their percentage of starch from their specific gravity. The author finds these tables incorrect.

Composition of Tea from Cachar.—Prof. Hodges.—From the CHEMICAL NEWS.

Nutrition of Fungi.—Prof. Ph. Zöller.—The cell devoid of chlorophyll has the power of developing the higher vegetable bodies, such as albumenoids, fats, and hydrates of carbon, from organic acids (acetic acid) in combination with ammonia and the mineral constituents of vegetables.

Experiments on the Cultivation of Sugar Beets, with Analyses of the Crop.—A. Stellter.

Experiments on the Cultivation of New Kinds of Potatoes.—Von Schuster.

Influence of the Quality of Seed upon the Crop.—F. Burgdorf.—The author's experiments confirm the view that select seed yields a better crop in proportion to the quantity sown.

Solutions of Sulphate of Copper—as regards their Influence on the Germinating Power of Wheat.—F. Haberland.—The action of blue vitriol is shown to be injurious. The author suggests instead of the use of such solutions to pass the grain rapidly through a space heated from 150° to 200° R., which would kill all adhering spores and germs without injuring the germinating power of the wheat.

Use of Kaolin as a Clarifying Agent.—B. Hoff.—The author denies the statement of Mach, that kaolin, used to clarify wine, attacks its red colour more than corresponding proportions of gelatin or isinglass. Below 10° C. the action of kaolin is imperfect.

Volatile Acids of Wine.—E. Duclaux.—Taken from *Comptes Rendus*, 1874, p. 1160.

Manufacture of Butter from Sour or Sweet Cream.—F. Söltoft.—The experiments appear in favour of sour cream, but the other conditions in the respective trials were not identical, whence the results cannot be considered as decisive.

Adulteration of Coffee.—A. Allen.—From CHEMICAL NEWS, vol. xxix., p. 129, &c.

Use of Carbolic Acid in Preparing Timber.—M. Boucherie.—From *Comptes Rendus*, 1874, p. 1757.

Degree of Heat at which Yeast-Cells Perish.—E. Schulmacher.—In a dry state these cells can bear a temperature of 100° C. for hours, and, for a shorter time, even a heat of 130° C. In the normal, moist condition they are not killed by a temperature of -113° C.

Anti-Putrescent Action of Salicylic Acid.—H. Kolbe and E. von Meyer.—The fact that salicylic acid, if heated above the boiling-point, splits up into carbolic acid and carbonic acid induced the authors to institute experiments on its antiseptic action. These experiments are not yet completed, but the results are in certain cases exceedingly satisfactory.

Les Mondes, Revue Hebdomadaire des Sciences.

No. 10, March 11, 1875.

Electrolytic Apparatus of M. Louis Maiche.—E. Girouard.—The author's iron-coke battery, as compared with that of Bunsen, consumes, for an equal amount of electricity, more than one-half less acid, and ten times less metal.

Ebullition of Sulphuric Acid.—A. Bobierre.—The ebullition of sulphuric acid can be conducted with as much regularity as that of water if a sufficient quantity of platinum is introduced into the retorts.

Speed of Light, and the Parallax of the Sun.—M. de Kericuff.

Hydrated Gelatinous Phosphate of Lime, and its Industrial Applications.—M. Claude Collas.—Dr. Sacc, of Neuchatel, has been engaged since 1866 in studying phosphate of lime, which he considers the most marvellous salt in nature. He found that it determines the putrid fermentation in animal matters, and the disaggregation of dead vegetable matter. He has since applied it as a mordant in dyeing. For this purpose the yarns or pieces are steeped in a solution of phosphate of lime in hydrochloric acid—more or less dilute, according to the judgment of the dyer—and then transferred to an alkaline dye-bath. The hydrated phosphate of lime precipitates colouring matters from their solutions, forming lakes.

The Electric Light in Workshops.—The electric light, so successfully introduced in the establishment of M. Hermann-Lachapelle, in the Faubourg Poissonnière, is produced by means of the magneto-electric machine of Gramme, an engraving of which is appended.

No. 11, March 18, 1875.

Manufacture of Chlorine Gas.—M. D. Lantier proposes to treat anhydrous bichloride of copper with hydrochloric acid.

New Observations on the Nature of Alcoholic Fermentation.—M. Pasteur.—This paper is not adapted for abstraction. The charge brought against the late Baron Liebig ought to have been preferred in his lifetime.

NOTES AND QUERIES.

Colouring Spirit.—Can any of your readers give the best method of making burnt sugar for colouring spirit from 35 to 40 over proof, the spirit remaining perfectly bright? The more the sugar is burnt the weaker is its power of colouring. How can it be made stronger, and which is the best kind of sugar to use?—J. M. S.

Vitriol Chamber.—Would any of your correspondents to "Notes and Queries" kindly inform me what size chamber I should require for making 5 tons of sulphuric acid per week from iron pyrites, and the best form of burner for the pyrites, and the size, together with quantity of nitre required per ton of ore?—M. S.

Cement for Leather.—Can any correspondent kindly favour me with a receipt for a cement to fasten rubber to bend leather? Ordinary solutions of rubber in benzol or bisulphide of carbon are not sufficiently efficacious for my purpose.—G. C.

MEETINGS FOR THE WEEK.

MONDAY, 10th.—Royal Geographical, 8.30.

TUESDAY 11th.—Civil Engineers, 8.

— Photographic, 8.

— Anthropological, 8.

WEDNESDAY, 12th.—Society of Arts, 8.

— Geological, 8.

THURSDAY, 13th.—Royal, 8.30.

— Royal Society Club, 6.30.

— London Institution, 7.

FRIDAY, 14th.—Royal Institution, 8.

— Quckett Club, 8.

— Anthropological, 7.30.

— Royal Astronomical, 8.

TO CORRESPONDENTS.

T. Farmer and Co.—*Dingler's Polyt. Journ.* and *Bulletin de la Soc. Chim. de Paris*.

A Constant Reader.—If the water contains no other ingredients but those you name it is not dangerous for dietetic purposes.

An Earnest Seeker after Truth.—The word "acid" is superfluous, and has been merely introduced by a clerical error. You are, of course, aware that the term "ester" was applied by L. Gmelin to the compound ethers formed by oxygen acids.

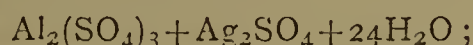
THE CHEMICAL NEWS.

VOL. XXXI. No. 807.

ON THE DOUBLE SULPHATE OF SILVER AND ALUMINIUM.

By SERGIUS KERN, St. Petersburg.

By the following method the double salt of sulphates of silver and aluminium was formed, or as it may be named silver-alum:—



this formula may be expressed:—



The silver sulphate for the experiments was prepared by treating a concentrated solution of silver nitrate by sulphuric acid, sp. gr. 1.84. When the ebullition of the liquor commenced a very interesting phenomenon was observed, the temperature all the time rose and fell exactly between 90° and 95°. The solution being evaporated gave a white powder of Ag_2SO_4 , soluble in 90 parts of water, and very easily soluble in caustic ammonia.

In a sand-bath on a small fire a solution of equivalent proportions of aluminium sulphate [$\text{Al}_2(\text{SO}_4)_3$] and silver sulphate (Ag_2SO_4) yields a compound crystallising in octahedral form, which proved to be silver-alum. With ammonium sulphate, $(\text{NH}_4)_2\text{SO}_4$, silver sulphate gives isomorphic crystals of silver-ammonium alum:—



It must be mentioned that ammonium and aluminium silver alums are very unstable compounds, very easily decomposing into their original substances.

NOTE ON THE ANALYSIS OF CAMBRIDGE COPROLITE.

By JOHN HUGHES, F.C.S.

TEXT-books on analytical chemistry recommend that the original acid solution of a mineral phosphate should be evaporated to complete dryness, previous to the removal of the insoluble siliceous matters; but I believe this is not done by chemists in this country, who are extensively engaged in the examination of mineral phosphates. Some experiments which I have lately made certainly show that where the magnesia phosphate method is employed for the estimation of the phosphoric acid in materials similar to Cambridge coprolite, the result obtained is greatly influenced by the previous evaporation to dryness of the acid solution. The following analyses have been selected as examples.

2 grms. of finely ground sample were taken for each analysis, and dissolved in dilute hydrochloric acid with a few drops of strong nitric acid; but in one set of experiments the acid solution was evaporated to complete dryness over a low flame, and the residue dissolved in nitromuriatic acid and water, gently warmed, and the insoluble siliceous matters filtered off; while in the other set of analyses the sand was filtered off as soon as the ground phosphate was sufficiently digested. In each case the filtrate from the sand was carefully neutralised, the lime precipitated by the addition of a known quantity of oxalate of ammonia in the presence of the necessary amount of citric acid and acetate of ammonia solutions, and the phosphoric acid determined by the well known magnesia method, care being taken to re-dissolve the magnesia phosphate precipitate after standing twelve hours (over night), and again precipitate it with ammonia,

the precipitate being allowed to stand two hours more before final filtration.

The magnesia phosphate precipitate when burnt and weighed was boiled with strong hydrochloric acid and a little water, after which any residue in the form of silica was filtered off, burnt, and weighed.

In calculating the results, however, no notice was taken of this silica in order to show the great difference in the duplicate determinations of the phosphoric acid.

A and B were samples of Cambridge coprolite; C was a sample of Charleston phosphate, a phosphatic deposit which has been used with advantage instead of Cambridge coprolite for the manufacture of superphosphate.

	By the usual plan without evaporation of the original acid solution.			After evaporation to complete dryness of the original acid solution.		
	A	B	C	A	B	C
Insoluble siliceous matter	8.10	8.70	10.05	9.20	8.50	10.05
Lime	42.70	42.68	42.08	42.58	42.56	42.00
Phosphoric acid	26.90	26.85	27.00	25.30	25.40	26.20
Equal to tribasic phosphate of lime	58.72	58.61	58.94	55.23	55.45	57.19
Silica left in magnesia phosphate precipitate	2.05	1.65	0.95	0.30	0.50	trace

From these results it would appear probable that by evaporating the original acid solution of the phosphate to complete dryness, and especially if the residue be subsequently heated over a moderate flame, the fluoride of silicon is entirely driven off. While in the analyses in which the acid solution was not so evaporated to dryness, hydrated silicate of magnesia is thrown down with the genuine ammonia magnesia phosphate precipitate.

I have examined the white and peculiarly acid deposit, which from time to time has to be removed from the exhaust pipe in connection with the mixing pits, and find that if a small quantity be boiled with dilute hydrochloric acid, the gelatinous silica filtered off, and ammonia added in excess in the presence of some citric acid, no precipitate will be produced, but on addition of ammoniacal magnesia solution a semi-gelatinous precipitate immediately appears, and upon stirring the liquid, gradually settles down to the bottom of the beaker.

This precipitate readily dissolves in hydrochloric acid, but again appears when ammonia is added in excess, and it may, I think, be considered identical in composition with the hydrated silicate of magnesia I have above alluded to, and which I believe is thrown down with the true magnesia phosphate precipitate in all the ordinary analyses of Cambridge coprolite (or any similar phosphatic deposit) where the original acid solution has not been evaporated to complete dryness.

Lawes's Chemical Manure Works,
Deptford, May 6, 1875.

APPENDIX ON THE ANALYSIS OF CRUDE ANTHRACEN.

By GEORGE E. DAVIS and T. H. DAVIS.

SINCE writing our paper upon the above subject, Lück's process has been objected to by several chemists, on the ground that it gives too high results in consequence of incomplete oxidation. This has probably been resulting from a hasty oxidation, though in some cases, as we have indicated in our paper, too high a result may be sometimes obtained.

In order to overcome this difficulty, Messrs. Meister, Lucius, and Brüning have issued the following circular, which we shall do best by giving in its entirety:—

"The correctness of our method for the analysis of anthracen has been doubted, and it has been stated that, in consequence of incomplete oxidation, the percentage in certain samples has been found too high.

"There are impurities in some samples which strongly

resist complete destruction by chromic acid, and we have endeavoured to find a method which will effect the complete oxidation and separation of these bodies so that nothing but pure anthrachinon remains.

"The method is as follows:—

"The first part of the process, *i.e.*, the solution of the sample in glacial acetic acid and gradual oxidation by chromic acid, as described in our former circular, remains the same. The anthrachinon thus obtained (washed with water only) is washed from the filter into a dish with 1 or 2 c.c. of caustic lye and boiled for five minutes with 1 c.c. of chameleon solution (permanganate of potash), the whole being well stirred. Should the red colour of the chameleon solution disappear, more is to be added until an excess is visible. After cooling, the liquid is rendered slightly acid by sulphuric acid, and a few crystals of oxalic acid added, which will effect the solution of the separated manganese compounds.

"The anthrachinon is then collected on a filter and washed, first with water, then with dilute alkali, again with water, and finally dried" at 100° C.

"The treatment of anthrachinon with permanganate solution occupies a short time only, and ensures the complete removal of all coal-tar impurities, anthrachinon alone remaining; we therefore consider the above treatment an essential perfection of our anthrachinon test.

"To avoid the errors involved in collecting on weighed filters, or filters counterpoised in the ordinary way, the following plan is recommended:—

"Two filters of equal size are selected and folded; the point, or cone, of one is cut off, so that, when folded together, the point of the inner projects through the cut part of the outer one to the extent of about half an inch; the two filters are then counterpoised exactly in a delicate balance, by cutting off small portions with scissors, and then folded together. The solution to be filtered is passed through both filters; after washing and drying, the inner filter, containing the anthrachinon, is placed in one pan of the balance, and the outer one in the other, adding weights till the counterpoise is perfect.

"The advantages of this method are, that it obviates errors—(1) from solution of the substance of the paper; (2) from scraping off some of the filter with the knife; and (3) from unequal absorption of moisture while weighing."

In adding this appendix to our paper, we may state that we have not made a trial of the improvements; we hope to do so shortly upon the dark green hydrocarbon, which we have found it so difficult to oxidise with chromic acid. We give the appendix so that the readers of the CHEMICAL NEWS may be acquainted with the latest on anthracen analysis.

SINGULAR ANOMALY OF THE SESQUIOXIDE OF IRON AS PREPARED FROM METEORIC IRON.

By J. LAWRENCE SMITH, Louisville, Ky.

IN my studies connected with the physical, chemical, and mineral characteristics of meteorites, several points of more or less importance have been observed which have as yet formed no part of my published observations on this class of bodies. One of these observations is, that the sesquioxide of iron, obtained in the result of the analysis of meteoric irons, is always decidedly affected by the magnet, although the temperature to which it may be heated prior to final weighing be but a moderate red-heat, only sufficient to furnish a certain constant weight. This phenomenon was at first attributed to small particles of organic matter from the filter, that may have caused the reduction of a minute portion of the sesquioxide to a lower oxidation. Still later I was led to suspect the presence of some new magnetic metal—a metal, however, closely allied to iron (other than cobalt and nickel, as the oxides of neither of these metals are attracted by the

magnet, whether obtained from meteoric iron or from any other source).

Experiments were undertaken to discover such metal, if any existed, but without success, and there the matter rested with me for several years, and until I commenced the study of the Ovipak iron, on which I am now engaged, in developing such facts connected with it as convince me that it is of terrestrial and not celestial origin, the results of which investigation I hope, before long, to submit to the Academy.

The observation in connection with the sesquioxide of iron resulting from meteoric irons was applied to that from the Ovipak iron, and it was also found to be attracted by the magnet. This anomaly showing itself in two irons that I supposed to be of different origins, it was resolved to make a critical investigation of the sesquioxide of iron obtained from both celestial and terrestrial sources; and if what follows appears too much in detail for the examination of so simple an observation, it was, nevertheless, necessary, in order to eliminate, as far as possible, sources of error, and to arrive at correct results.

Materials, &c., used in the Experiments.

The irons experimented with were dissolved in a large excess of a mixture of equal parts of chlorhydric and nitric acids. The filters used were old cotton cloth (perfectly free from lint), stretched over a funnel; the quantity of iron used did not exceed 1 grm.; the filtration was rapid, and the washing very easy and thorough. Other filtrations were made in funnels, the necks of which were plugged with asbestos.

The heating was conducted in thin, glazed porcelain crucibles, of about 40 c.c. capacity, and the heat applied by a small Bunsen burner of 5 cubic feet capacity per hour, the top of the flame spreading over the bottom and one-half of the sides of the crucible, thus heating to redness 2 or 3 decigrammes very readily, the amount usually employed.

As for the magnet used, I would state that as sesquioxide of iron, in a strict sense, ranks among the magnetic compounds, yet this is only true when very powerful magnets are brought to bear upon it; so the magnet used in all the experiments was a feeble one,—a small horse-shoe magnet, capable of sustaining about 200 grms. when the two poles were connected, and, when used, one of the angles of one of the poles was brought near to the particles of oxide experimented with.

First Series of Experiments made with Pure Sesquioxide of Iron.

The first sesquioxide used was prepared from the purest commercial iron, dissolved in equal parts of chlorhydric and nitric acid, diluted, filtered, and precipitated by an excess of ammonia after filtration.

1. Dried at 110° C., crushed to fine particles, but not pulverised. The magnet, being brought within 1 m.m. of these particles, *would attract them feebly.*

2. The same heated to 250° C. still showed signs of magnetism.

3. Heated to 425° C. the magnetism entirely disappeared, or could only be made apparent upon the very smallest particles.

4. At red-heat the *magnetism had entirely disappeared*, whether the heat was continued for five or ten minutes only, or during several hours.

All the tests with the magnet were made when the heated oxide had cooled; and the same was done in all the experiments referred to in this paper.

The second sesquioxide of iron used was prepared from pure protosulphate oxidised by nitric acid, and precipitated by ammonia. This, when dried, heated, and tested in the same manner as in the former experiments, gave similar results, *viz.*, that hydrated sesquioxide of iron was always slightly magnetic when dried at a low temperature (even at 50°); but at high temperatures, as red-heat, all magnetic property disappeared.

The third sesquioxide of iron was prepared from hemical pure iron, of which I had a small quantity resented to me by Johnson and Matthey, of London, hat had been made with great care by Mathiessen. The esults of these experiments differed in no way from those ust detailed.

Second Series of Experiments, with Sesquioxide from Meteoric Iron.

I next took meteoric iron with which to prepare the sesquioxide, using irons from a variety of sources. Those experimented with were the Toluca, Cranbourne, Russel Gulch, Sevier Co., Robertson Co. irons, and the iron from the stony meteorite that fell at Parnallee. These irons were dissolved in the same way as the iron in the first series, viz., with a large excess of chlorhydric and nitric acids, in equal parts, and most of the excess of acid driven off over a water-bath. The solution was then diluted, filtered, and poured into a beaker of hot distilled water, to which had been previously added a large excess of ammonia. The precipitates were washed and dried precisely as in the first series, and oxides examined by the magnet. The following were the indications given by all the oxides, with but very slight difference in degree:—Dried at 110° C., sensibly magnetic when the magnet was brought nearly in contact with the fine particles. Heated to 190° C., magnetism exhibited was about the same; at 300° C., slightly increased; at 450°, decidedly magnetic—and at red-heat more strongly magnetic—particles, 2 or 3 m.m. in diameter, being attracted at some little distance. It made no essential difference if the red-heat was continued only for a few minutes or several hours.

It will be remarked, in this series of experiments, that the effect of heat was just the reverse of what occurred in the first series; for in those experiments what little magnetic property existed in the oxide as first prepared, disappeared entirely when the oxide was brought to a red-heat.

I would here remark that the sesquioxide, as usually prepared by me in the analysis of meteoric iron, differs somewhat from the above, the iron in solution being first precipitated by boiling with acetate of soda, and the subacetate of iron subsequently converted into oxide; but the oxide thus prepared still exhibits magnetic properties analogous to that formed by using an excess of ammonia.

From the above results, the question naturally arises as to what is the cause of the difference in the first and second series of experiments; for the conditions under which the oxides were formed are as nearly the same as it was possible to make them, and they were made side by side at the same time.

In the first part of this communication it was stated that I supposed it might be due to a new metal closely related to iron, but whose oxides were all attracted by the magnet: this idea was discarded after varied and careful experiments that failed to give any evidence of the correctness of such an assumption.

The only thing left for me to do was to look into the oxides of iron from meteoric iron, and see what impurities they contained, and ascertain if these impurities played any part in this magnetic anomaly. It is well known that when a solution of meteoric iron is precipitated by an excess of ammonia, the oxides of nickel and cobalt at first precipitated along with the sesquioxide will be re-dissolved, but only in part, leaving often from 1 to 3 per cent of these oxides mixed with the oxide of iron. It is further known that while nickel and cobalt can be very nearly separated from iron by means of the acetate of soda, still a sensible portion will be left in the precipitated oxide of iron; so much so, that when I aim at exceeding accuracy in this separation, the subacetate at first precipitated (after partial washing) is re-dissolved and re-precipitated by the acetate of soda, and this operation repeated a second and a third time. While there is nothing in the presence of the oxides of nickel and cobalt

that would lead to any explanation of the phenomenon under discussion (for neither of these oxides is affected by the magnet), still I was determined to see what would be the condition of the oxide of iron prepared from meteoric iron after four re-solutions and re-precipitations by acetate of soda, finally converting the subacetate of iron into the sesquioxide by dissolving it in aqua regia, and precipitating by ammonia.

The sesquioxide thus prepared no longer possessed the properties of that indicated in the second series of experiments, but showed the same properties as the ordinary oxide of the first series, viz., not attracted by magnet after heating to redness.

It being evident that the minute quantity of the oxides of nickel and cobalt remaining in the sesquioxide, as prepared from meteoric iron, had something to do with the phenomenon under consideration, I was led to institute a third series of experiments, using the sesquioxide from ordinary iron.

Third Series of Experiments with Sesquioxide of Iron prepared from Pure Iron, mixed with Oxides of Nickel, Cobalt, and other Metals.

A quantity of a solution of the sesquioxide was prepared by dissolving pure iron in a mixture of equal parts of chlorhydric and nitric acids, and a portion of the solution equal to about a gramme of the metal used in each of the subsequent experiments, adding to the solution of iron a solution of the other metals in the same acids prior to precipitation by ammonia.

Some of the iron solution, without any admixture, was precipitated, and the sesquioxide examined as in Series 1st, and being satisfied that the pure oxide gave no indication of magnetic attraction, the experiments were proceeded with.

Exp. 1.—A solution of the mixed oxides of nickel and cobalt, as obtained from meteoric iron, was added to some of the above solution of iron (the nickel and cobalt oxides representing about 10 per cent of the iron) precipitated by large excess of ammonia, dried, and tested with magnet before and after heating to redness, and the magnetic results were just the same as if we had been experimenting with meteoric iron, detailed in Series 2nd. This experiment was frequently repeated, and always with the same result.

Exp. 2.—Same experiment as last, only using oxides of nickel and cobalt from ordinary sources; the results were the same, only not quite so marked.

Exp. 3.—Pure nickel oxide was used, with similar results.

Exp. 4.—Pure oxide of cobalt was used with similar results.

While the above experiments throw some light upon the subject, they in no way explain the phenomenon, for none of the oxides separately exhibit the magnetic property. I therefore continued the experiments, using other metals besides nickel and cobalt.

Exp. 5.—Ten per cent of copper, dissolved in nitric acid, was added to a portion of the solution representing a gramme of iron, and precipitated with an excess of ammonia. The oxide dried and heated as in the previous experiments. When tested with the magnet it gave indications similar to the oxide from meteoric iron, but less in degree. In subsequent analyses of this oxide, thus precipitated, it was found to contain nearly 3 per cent of oxide of copper.

Exps. 6, 7, 8, 9, and 10.—In these experiments oxides of manganese, gold, platinum, zinc, and cadmium, were employed as admixtures with the iron; but in all cases the precipitated oxides differed in no way from the pure oxide of iron; when tested by the magnet evincing no attraction after being heated to redness.

The above experiments embrace all that I have made up to the present time, and the results that are new may be summed up as follows:—

1. That artificial hydrated sesquioxide of iron, dried at low temperatures, is attracted feebly by the magnet, but loses this property at and below red-heat.

2. That sesquioxide, precipitated in the ordinary methods from solutions of meteoric iron, and dried at a low temperature, acts similarly to the ordinary oxide, but differs from it in that it becomes decidedly magnetic on being heated from 400° C. to a red-heat.
3. That the sesquioxide from ordinary iron, mixed with nickel or cobalt, or both, from whatever source, exhibit magnetic properties identical with that from meteoric iron.
4. That the sesquioxide of iron from meteoric iron, freed entirely from traces of nickel and cobalt, corresponds to the ordinary sesquioxide in its behaviour to the magnet.
5. That the sesquioxide made from iron mixed with copper resembles that from meteoric iron.
6. That the sesquioxide from iron mixed with manganese, gold, platinum, zinc, or calcium, differs in no way from the pure sesquioxide in its magnetic reaction.

A natural inquiry is—What is the cause of this change in the sesquioxide of iron when mixed with oxides of nickel, cobalt, or copper? Analyses of mixed oxides

NOTES UPON SUGAR ANALYSIS.

By G. C. STEWART, F.C.S.,
Greenock.

DURING the last few years I have devoted much attention to the subject of sugar analysis; besides making many chemical analyses of *raw* sugars, I have analysed a great number of samples of crushed or refined sugar, manufactured in different sugar refineries throughout the country. When sugar is so very cheap, and every inducement thus offered to promote adulteration, when a new class of men has been constituted to watch over the food of the country, there is need for special communications upon this most interesting and important subject. Sugar, as met with in commerce, may be composed of crystallisable and non-crystallisable sugars, soluble salts, moisture, peroxide of iron, and other organic matter of undefined composition. The following analyses must not be considered as typical of the various kinds of sugar, for all of them vary exceedingly, but they give a fair idea of the composition of the sugars passed through the market.

	Per cent.														
	Egyptian Crystals.	Java (damaged).	Trinidad.	Cuba.	Bahia.	Melado.	Pernambuco.	French Beet Sugar (fine).	German Beet Sugar (low).	Crystallised Refined Sugar.	Crushed Sugar (1st class).	Crushed Sugar (2nd class.)	Crushed Sugar (3rd class).	Crushed Sugar (4th class).	Refined Syrup.
Crystallisable sugar ..	98.616	90.529	71.049	93.681	83.586	62.576	90.685	95.968	82.112	99.388	95.282	92.171	89.941	85.607	50.540
Non-crystallisable sugar	0.701	4.062	16.000	0.391	5.762	12.365	4.688	0.016	0.336	traces	1.268	3.826	4.391	5.963	21.888
Extractive organic matter ..	0.192	2.369	6.009	0.802	2.516	2.489	0.445	0.220	0.445	—	—	0.041	0.331	0.584	4.571
Insoluble organic matter ..	0.001	0.065	0.124	0.655	0.138	0.056	0.059	0.003	0.015	—	—	—	—	—	—
Sand and clay ..	0.124	0.254	0.778	0.071	0.208	0.692	0.664	0.584	0.069	—	—	—	—	—	—
Soluble alkaline salts ..	0.130	1.283	1.263	0.963	0.750	0.859	0.424	0.315	6.364	0.031	0.187	0.581	0.758	1.698	2.934
Peroxide of iron ..	—	traces	traces	—	traces	traces	traces	traces	traces	—	—	traces	traces	traces	traces
Moisture ..	0.236	1.438	4.777	3.427	7.040	20.963	3.035	1.894	6.659	0.581	3.263	3.381	4.529	6.148	20.067
	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Crystallisable sugar, obtainable ..	97.265	80.052	48.734	88.475	74.074	45.916	83.877	95.377	49.956	—	—	—	—	—	—
	Degrees.														
Polarisation ..	98.830	91.060	71.561	94.164	84.063	62.761	90.863	97.158	82.513	99.795	95.548	92.348	90.341	86.000	51.001
	Per cent.														
Total insoluble matter ..	0.125	0.319	0.902	0.736	0.346	0.748	0.723	0.587	0.084	—	—	—	—	—	—
Total ash ..	0.254	1.537	2.041	1.034	0.958	1.551	1.088	0.899	6.433	0.031	0.187	0.581	0.758	1.698	2.934
COMPOSITION DIRECTLY DETERMINED.															
	Per cent.														
Organic matter ..	99.509	97.024	93.181	95.537	92.000	77.480	95.876	97.318	86.907	99.386	96.549	96.107	94.713	92.153	76.997
Moisture ..	0.236	1.438	4.777	3.427	7.040	20.963	3.035	1.894	6.659	0.581	3.263	3.381	4.529	6.148	20.067
Ash ..	0.254	1.537	2.041	1.034	0.958	1.551	1.088	0.899	6.433	0.031	0.187	0.581	0.758	1.698	2.934
	99.999	99.999	99.999	99.998	99.998	99.994	99.999	100.111	99.999	99.998	99.999	100.069	100.000	99.999	99.998
* Undetermined matter.															

have thrown very little light on the subject; for by carefully reducing the oxides by hydrogen, analysing the mixed metals (that usually gave from 2 to 3 per cent of the copper, nickel, or cobalt), and, calculating on the basis of all the iron being sesquioxide, my analytical results and calculations never differed more than from 1 to 1½ m.grms. in 1 grm. of the oxide that was used, and this difference is within the limits of error, yet it corresponds to amount of from 2 to 3 per cent of Fe₃O₄ mixed with the sesquioxide. And in want of any better explanation, I must suppose that the presence of the small amount of oxides of these foreign metals causes a reduction of a minute quantity of the Fe₂O₃ to Fe₃O₄, although a bright red-heat, however long continued, will not increase the magnetic property of the oxide, it having received its maximum as soon as it arrives at a red-heat.*

* It has been suggested to me, by Prof. C. F. Chandler, that the nickel, cobalt, and copper oxides present may form, with the sesquioxide of iron, a magnetic oxide, thus:—NiO + Fe₂O₃ = (NiFe)₃O₄. The suggestion is a reasonable one, and worthy of consideration.

The Crystallisable Sugar is best estimated volumetrically by Fehling's method. It must first, however, be converted into grape sugar, by protracted ebullition with dilute acid. I always conduct this experiment over a steam-bath, closing the neck of the glass flask with a perforated caoutchouc cork, carrying a glass tube bent in an obtuse angle which leads to a Liebig's condenser (turned upwards); the evaporated water thus flows back into the flask. After all the crystallisable sugar has been converted into grape sugar, the free acid is then neutralised by running in a dilute solution of pure sodium carbonate, and when perfectly cold it is diluted with water to a known volume, and then titrated in the usual way. One hundred parts of grape sugar are equivalent to 95 parts of crystallisable sugar. The results are not so satisfactory, as the boiling with dilute acid may convert some of the grape sugar into caramel. In analysing sugars practically, the sum of the crystallisable sugar is, however, always found by difference, and is then quite reliable.

Polarisation.—Frequently, recourse is had to the power which a solution of crystallisable sugar has of turning to the right the plane of polarised light. When, therefore, a liquid contains crystallisable sugar without any other substance possessing the same optical property, the quantity of sugar may be estimated by measuring the deviation which the liquid produces in the plane of polarisation. To apply this, the deviation must be known produced by a standard solution of pure crystallisable sugar; and from this we can readily calculate the deviation produced by any other standard solution of sugar the richness of which we wish to ascertain. Upon the theory of this optical method is constructed the *saccharimetre-soleil* of Duboscq and others.

The polarising saccharometer, as considered from a practical point of view, is an exceedingly simple instrument. Sugar refiners not accustomed to manipulate it would readily mistake it at first sight for a family telescope; but, in reality, it is constructed of three parts, two of which are fixed, the other movable. The latter tube, which is of standard dimensions, is destined to hold the sugar solution the richness of which we wish to ascertain. There is a little movable tube, or eye-piece, to which the eye is applied, and which may be worked out and in until the polariscope has been properly focussed. The latter should be set in such a position in the laboratory that the flame of a gas lamp will shine through the whole arrangement, including the sugar solution, and care should be exercised to have the apartment as dark as possible. A mechanical arrangement, or "button," serves to regulate the saccharometer—*i.e.*, to cause the zero of the scale to coincide with the indicator. Another large horizontal "button" renders the observed tint, or shade, uniform, while a third arrangement assists in changing the colour of the disc best suited to the eye of the operator. There is also a graduated scale which supplies information about the richness in crystallisable sugar of the solution which may be under examination.

Before beginning the experiment, obtain an argand lamp, and elevate it about 2 feet above the level of the laboratory bench. Secondly, cover it completely with a copper wrapper, in the side of which must be drilled a circular hole, corresponding exactly in size with the glass at the end of the polariscope. Now light the gas lamp, and trim the flame so that a circle of the yellow portion will be obtained in the brightest degree possible. Place the saccharometer close up to this, and in such a manner that the reflected light will traverse through it in an horizontal direction. Secondly, let a tube be filled with distilled water, and set it in the instrument in the place reserved for it, between the eye-piece and the object-glass; then let the polariscope be carefully worked into the focus which suits best the sight of the operator, and until a circular surface or disc is obtained, divided into two equal parts equally tinted or coloured, or two separate tints or colours parted from one another by a black line, which must appear well cut and quite perfect. If, as generally happens, the two half circles have not the same tint or shade, *i.e.*, they do not blend, then turn the large horizontal button from left to right, or right to left, until the tint of the two circles is perfectly identical, and until the eye can no longer discern any difference between them. Again, it is not enough that the two half circles should be of the same tint; it is, further, necessary that the experiment should be conducted with the greatest possible amount of accuracy, and that this tint of uniformity should be the most sensible one possible. Every analyst, in using the saccharometer, should find out the shade of colour best suited for his eyesight; he ought to adopt it in all his experiments, as it is not advisable to use a number of colours during polarisation. If, while looking through the saccharometer, we make the milled head turn, we shall perceive that the colour of the two half discs changes incessantly, and that they repeat after each half turn. Supposing that the operator stops the rotation when the two half discs are of a yellow tint, both of which

should be identical, beginning from the instant the milled head is rotated very gently in the same direction, green follows yellow, blue, green, indigo-blue, and lastly violet-indigo. If we look attentively, we shall come upon a certain shade, for which the uniformity of tint at first established for the yellow no longer exists; we shall see a difference which we might not at first notice. The same experiment repeated many times, and on different days, allows us to verify the shade which presents a different tint, when with another colour we see the quality of tint is always the same. Now, such a shade for polarisation is the most suitable, and the operator ought always to remember it and adopt it as his starting-point. For the greater number of experimenters, the delicate shade is the violet-blue tint, which recalls the colour of the flower of the foxglove, and for others yellow, or some brilliant colour. The violet-blue possesses this advantage, that if, while looking at it, we turn the milled head of the saccharometer infinitely little, one of the semicircles passes suddenly to red, the other to green. Consequently, upon rotation, the operator instantly stops whenever uniformity of tint is established. Observe if the zero of the scale corresponds exactly with the indicator; if this coincidence be not perfect, then make it so, and the polariscope is adjusted.

Take out the tube of water, and substitute for it the tube containing the sugar solution. If, working by inversion, uniformity of tint no longer appears, re-establish by rotation and proceed as before. This done, note the mark on the scale to which the mark upon the indicator corresponds. If the saccharometer has been adjusted very accurately, the indicator should exactly register 100°, distilled water being 0°.

With regard to the preparation of the sugar solution, it is usually of such a strength that 16.35 grms. of pure crystallisable sugar are dissolved in 100 c.c. of distilled water. In polarising raw sugar solutions, it is best to precipitate the extractive organic matter from them, by the addition of a few drops of tri-plumbic acetate solution, and then pass the mixture through a filter of chemically pure animal charcoal. In this way, all traces of the lead salt are removed, which is absorbed by the charcoal, and the sugar solution is obtained as clear as water. In the case of beet-sugar solutions, the addition of the head is unnecessary, the charcoal filter being sufficient.

For beet sugars, molasses, syrups, or "sweet waters," the saccharometer answers admirably, the rapidity with which the results are obtained from it, together with its extreme accuracy, places it at the top of all other methods for the estimation of crystallisable sugar.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 6, 1875.

Professor ODLING, F.R.S., Vice-President, in the Chair.

AFTER the names of the visitors had been announced and the minutes of the previous meeting read and confirmed, the names of Messrs. A. A. Nesbit, W. H. Martin, C. T. Blanchard, B.A., G. Crampton, J. C. Butterfield, J. W. Swan, A. W. Blyth, R. Stellan, G. Purdie, Jun., and the Rev. W. J. J. Welch, M.A., were read for the first time. Messrs. William Mogford Hamlet, Henry Mitchell Hastings, H. S. Carpenter, Alfred Southall, and William Alexander Little were duly elected Fellows of the Society after their names had been read for the third time.

The first paper, "*On Andrews'ite and Chalkosiderite*," was read by the author, Professor N. Story Maskelyne. This mineral, which is named after Professor Andrews, is found in Cornwall in globular forms of a dark green

colour, often associated with cuprite, and in habit singularly resembling wavellite. It occurs on gangue of ferruginous quartz, and in many respects resembles the well-known mineral dufrénite. It may be represented by the formula $2(2\text{Fe}_2\text{P}_2\text{O}_8 + \text{Fe}_2\text{H}_2\text{O}_4) + \text{CuH}_2\text{O}_2$. The other mineral which accompanies Andrews' site in bright green crystals was found by comparison with specimens of old date in the British Museum to be identical with the chalkosiderite of Ullmann. This mineral, which was examined before the blowpipe by Ullmann (who found the copper and iron, but missed the phosphoric acid) has hitherto been erroneously placed by mineralogists with dufrénite. It occurs in clustered groups or sheaves of blunt striated prisms, the minute size and the rounded striated faces of which render accurate measurements exceedingly difficult. Its composition may be represented as—



Professor ODLING having thanked the author,

The SECRETARY read a communication from Dr. W. Flight entitled "*An Examination of Methods for Effecting the Quantitative Separation of Iron Sesquioxide, Alumina, and Phosphoric Acid.*" After reviewing the various processes for the separation of phosphoric acid from alumina and also from iron, and giving the details of various modifications of some of these processes which he had tried, the author described the process ultimately adopted, which consisted in boiling the solution containing the alumina, iron, and phosphoric acid, and which should not be very acid, for two or three hours with excess of sodium hyposulphite. All the alumina with a part of the phosphoric acid was precipitated, whilst the iron with the rest of the phosphoric acid remained in solution. From this solution the iron could at once be precipitated by ammoniacal hydric sulphide, and converted into ferric oxide, whilst the alumina and phosphoric acid in the precipitate were separated by treatment with excess of caustic soda and barium chloride, which precipitates the phosphoric acid in combination with the barium, whilst the alumina remains in solution. In washing the precipitate a few drops of soda solution must be added to the wash-water, as the phosphate is decomposed by pure water. This phosphate was then decomposed by sulphuric acid, and the phosphoric acid determined in the usual way. In conclusion, the author noticed the decomposition which solution of sodium phosphate undergoes in contact with glass or porcelain from its removing the silica from it, and also a notice of some experiments made with a view to convert ortho- into meta-phosphoric acid.

The CHAIRMAN said they were much indebted to Dr. Flight for this process, which, in his hands, at least, gave such satisfactory results.

Mr. WARINGTON said he was able to confirm many of the statements of the author, especially that phosphoric acid was not completely precipitated by magnesia when alumina was present. On the other hand, with iron the separation was perfect. One point of especial interest to him, as he had paid some attention to the decomposition of calcium phosphate by water, was the decomposition of barium phosphate under similar circumstances. There was, however, this difference, that the latter appeared to be more readily attacked, for cold water had a perceptible action on it, whilst the former was only decomposed by hot water.

Dr. DEBUS understood Dr. Flight to state that Sonnenschein's molybdic acid method in the presence of alumina and iron, although accurate enough for ordinary purposes, was not so for scientific purposes. He, however, gave no comparison of results obtained by the two processes. As far as he was himself concerned, he had always obtained excellent results by this method.

Professor MASKELYNE, in reply, said his own impression was that the barium phosphate was slightly soluble in pure water, and was not decomposed by it. With regard to Sonnenschein's method, the objection to it was that in this particular instance it was necessary to determine

phosphoric acid, alumina, ferric and ferrous oxide, and the use of nitric acid, required for the molybdic acid process, necessarily complicated the matter of the determination of the ferrous oxide.

A paper "*On Sodium Ethyl-Thio-Sulphate,*" by Mr. W. RAMSAY, was then read. The author finds that the precipitates obtained on adding silver nitrate or a mercuric salt to sodium ethyl-thio-sulphate are very unstable, being readily decomposed, with formation of metallic sulphides; also, that when the sodium salt is heated with phosphoric chloride, phosphoric oxychloride and ethyl disulphide are produced, but no sulphuryl chloride, as stated by Spring. At the same time, a small quantity of a brown oil is formed, which is freely soluble in alcohol and ether with a beautiful crimson colour, but only sparingly soluble in water.

Mr. JOHN WILLIAMS then read a paper "*On a Milligrade Thermometric Scale.*" After pointing out the disadvantages attending the use of the centigrade scale, arising from the size of the divisions, and the comparatively high temperature of the zero-point, necessitating the use of the minus sign, the author suggested the substitution of the freezing- and boiling-points of mercury for those of water, fixing the one at -40°C . and the other at 360°C ., and dividing the scale into 1000 parts. The freezing-point of water would then be 100° , and its boiling-point 350° , whilst 5 milligrade degrees would be equal to 2°C .

Dr. ODLING remarked that when the centigrade thermometer first began to come into use in this country, the objections made to it were the largeness of the degrees and the high zero-point. It possessed the great advantage, however, that the determination of the melting-point and boiling-point of water could be made easily and accurately. The enormous amount of literature and of work in which the centigrade was used would be a great obstacle to the introduction of Mr. Williams's milligrade scale.

The last paper was "*On a New Method of Supporting Crucibles in Gas-Furnaces,*" by Mr. C. GRIFFIN. In the author's gas-furnace, a description of which was communicated to the Society in 1870, the perforated plumbago cylinder, and the trivet-grate on which the crucible is supported, are liable to break when white-hot, occasionally giving much trouble; moreover, the latter has the disadvantage of interfering with the direct action of the flame on the crucible. This, however, is entirely obviated by the new burner, in which a space is left round the central jet, which has fitted over it an atmopyre similar to those used in Hofmann's combustion-furnace. The bottom of the crucible rests on this, and the plumbago cylinder is thus relieved of all pressure. These new burners are very economical and of great power, a small one, burning 20 feet of gas per hour, being capable of melting half-a-pound of cast-iron in thirty-five minutes; or of heating a muffle, 5 inches long and 3 wide, to a temperature sufficiently high for assaying. Several varieties of the furnace were exhibited, one of which was in action.

Dr. ODLING having thanked the author for this addition to the many pieces of apparatus which he and his father had introduced to the notice of chemists, the meeting was adjourned until Thursday, May 20, when the following papers will be read:—

(1.) "Note on Milk in Health and Disease," by A. Smee, jun.; (2.) "The Effects of Pressure and Cold upon the Gaseous Products of the Distillation of Carbonaceous Shales," by J. J. Coleman; (3.) "On some Nova Scotian Triassic Trap Minerals," by Professor How; (4.) "On some Points in the Examination of Waters by the Ammonia Method," by W. H. Deering; (5.) "On the Agricultural Chemistry of Tea Plantations of India," by D. Campbell Brown; (6.) "On the Structure and Composition of Certain Pseudomorphic Crystals having the Form of Orthoclase," by J. A. Phillips; (7.) "On Nitrosyl Bromide and on Sulphur Bromide," by M. M. P. Muir.

PHYSICAL SOCIETY.

May 8th, 1875.

Professor GLADSTONE, F.R.S., President, in the Chair.

Mr. CROOKES, F.R.S., exhibited and described some very important experiments "*On Attraction and Repulsion Resulting from Radiation*," which he has recently submitted to the Royal Society, and of which an account has already been given in the CHEMICAL NEWS (vol. xxxi., p. 189). It is unnecessary, therefore, to describe them at length, but it may be pointed out that one of the most beautiful of the instruments is one which Mr. Crookes calls a radiometer. It consists of four arms suspended on a steel point resting in a cup, so that it is capable of revolving horizontally. To the extremity of each arm is fastened a thin disc of pith, lamp-black on one side so that the black and white faces alternate. The whole is enclosed in a glass globe, which is then exhausted as perfectly as possible, and hermetically sealed. Several of these instruments varying in delicacy were exhibited, and experiments made showing the influence of light and heat of different degrees of refrangibility, and in proof of the law of inverse squares, &c.

The PRESIDENT, in expressing the cordial thanks of the Society, referred to Mr. Crookes's statement that the repulsion was proportional to the length of the vibrations, and asked whether at the red end of the spectrum there was an abrupt termination of the action, and a gradual diminution towards the ultra-violet.

Mr. WALENN inquired as to the action of the magnet, and of different axes of crystals in causing repulsion.

Prof. WOODWARD made some observations with reference to the manipulation.

Prof. GUTHRIE observed that in looking back along the glorious course of physical research upon those great land-marks of discovery which serve alike as consummations of past, and as points of departure for future progress we involuntarily classify them in two great categories. Of many the value far outweighs the merit. In these, by some stroke of fortune almost akin to blind chance, or by some flash of genius for which there is scarcely another name than inspiration, a whole vista of the hitherto unknown is displayed. In others a result of apparently trifling significance is the outcome of years of the most patient labours. I venture to express my own very strong conviction that Mr. Crookes's discovery has, almost in an unparalleled degree, both elements of greatness. Years of labour performed with infinite faith in the truthfulness of nature, with steadfastness, forethought, and perhaps unique manipulative skill, have resulted in a discovery, to find the counterpart of which in interest and importance we should have to look closely into, and far down, the records of the past. Grateful as all scientific men must be for the great gift of knowledge which they have received at Mr. Crookes's hands, that gratitude is much enhanced by the modesty so becoming his genius and good fortune which has restrained him from premature theorisation, and which has decided him, despite the speculations with which his brain must have been teeming, to permit these great facts to speak in the unsophisticated language of experiment.

Mr. CROOKES stated, in reply to Dr. Gladstone's question, that the opacity of the glass envelope of the radiometer for extreme rays must be taken into account in considering the action of the rays of different refrangibility, and further, that the increased effect due to red light may have been in part due to the concentration of rays of low refrangibility, which attends the use of glass prisms. A diffraction spectrum might give a different result. He added that when a ray falls on a surface capable of motion which reflects it very little work is done, but if the surface quenches the ray motion is produced. He then thanked Prof. Guthrie for his kindly remarks.

Prof. CORNU, of the Ecole Polytechnique, described his

recent experiments on the determination of the velocity of light. He gave an account of the method of Foucault, and exhibited the complete apparatus including the arrangement of mirrors for multiplying the distance through which the luminous ray passed between the two reflections from the revolving mirror. He described the toothed wheel of Fizeau, and the improvements which he had himself made in his own determinations by this method. He found that it was impossible to give an uniform motion to the toothed wheel, and therefore adopted an electrical registering apparatus to mark the increase of its velocity, an electric signal enabling the observer to point out the instant at which the right velocity is obtained. Another very important improvement is the substitution of a pair of observations of the return rays for the single observation of a total extinction. Prof. Cornu's most recent determination was made in the summer of 1874, the two stations being the Paris Observatory and the Tower of Montthéry, 14½ miles apart. A mean of 508 experiments gave 300,400 kilometres, or 186,660 miles per second.

Prof. ADAMS, Vice-President, mentioned that M. Cornu had contributed in no small measure to the success which had attended the formation in France of a Society closely corresponding to our British Association, and assured him that the Physical Society felt grateful for his presence, as he could well understand the difficulty with which the early days of such a Society were beset.

Prof. CORNU stated, in answer to a question of Prof. G. C. Foster, that he objected to the revolving mirror method, because the distance to be traversed by the light was very small, and because the path of the ray lay through a vortex of air produced by the rapid revolution of the mirror.

SOCIETY OF PUBLIC ANALYSTS.

THE SALE OF FOOD AND DRUGS BILL.

WE had indulged the hope that in any further reference to this Bill we should have been able to speak of it as a completed measure, but so wearily does it "drag its slow length along" that—though it was read a second time on February 19th, and committed on March 4th—we have reached the middle of May, and it is still in an unfinished state. Seldom, we should imagine, has such a small Bill led to so much discussion, or been subjected to so many alterations at the hands of its authors.

In our issue of April 23rd we noticed the amendments which had been carried on the first five clauses. On the 6th inst. the House devoted considerable time to the discussion of the Bill, and numerous amendments were disposed of, most of them being either withdrawn or negatived.

Mr. SANDFORD once more recited the thrice-told tale about the incompetency of the Public Analysts, and was (as might have been expected) forcibly, if not ably, supported by Sir Henry W. Peek.

As an antidote to this "incompetency" on the part of scientific men, of which lawyers and tea dealers are obviously the best judges, two remedies were proposed:—The one of the Hon. Member for Maldon was simply to make the county magistrates the appointing bodies in all cases. This proposal is exceedingly simple, but the House seemed to think that its simplicity would be combined with utter futility.

Sir HENRY WILLIAM PEEK proposed a bolder and more practical course. He would ensure the impossibility of there being any incompetent Public Analysts by the mild expedient of abolishing Public Analysts altogether. It need hardly be said that in an assembly of intelligent men, anxious in the main to do justice, the brilliant suggestion of the Hon. Baronet who represents the dual constituency of Mid-Surrey and Mincing Lane was not adopted.

In Clause 9 Dr. LYON PLAYFAIR proposed an amendment, for the purpose of providing that a Public Analyst should not be at the same time engaged in the business of buying or selling articles of food or drugs. This was much debated, and though little was said, or can be said, against the principle of the amendment, it was fairly urged that—in some appointments already made—pharmaceutical chemists had proved to be good analysts as well, and that it would be unjust to deprive them of their appointments. Eventually the amendment was withdrawn, but on the understanding that Mr. Sclater-Booth would add words when bringing the Bill up, on report, to meet Dr. Playfair's views.

In Clause 16, on the motion of Dr. Cameron, the penalty for refusing to sell articles for the purpose of analysis was increased from £5 to £10.

In Clause 18 a provision was inserted directing local authorities to make an annual report to the Local Government Board of the number of articles analysed in their respective districts.

The Bill was again under discussion on Tuesday last, the 11th inst., the following being the net result of a debate of some length:—

In cases of disputed analyses, where the defendant desires a further examination of a sample to be made, it shall be competent for the Justices hearing the case to direct that the article be referred to be analysed by "Chemical Officers in the employment of the Inland Revenue."

The manifestly unfair suggestion that the certificates of such officers should be considered "final" was, of course, repudiated by the Government; and whether a chemist be an *employee* in Somerset House, or an Analyst in independent practice, he will equally be liable to be called on to give the figures of his analysis on oath, and submit himself to cross-examination.

A meeting of the Council was held at the Cannon Street Hotel on Wednesday, the 12th inst., when (in accordance with an instruction of the General Meeting of the 5th inst.) the question of some analyses of coffee recently made by the Analyst for Northamptonshire was fully discussed, and the following resolution was passed:—"That the proceedings in connection with some recent analyses of coffee made by Mr. Joseph Young, of Leicester,—resulting in the prosecution for adulteration of a number of persons, afterwards admitted to be innocent,—having been laid before the Council, together with Mr. Young's written explanation, the Council are of opinion that such explanation is eminently unsatisfactory, and they regret that Mr. Young should have certified to adulteration on such insufficient grounds."

NOTICES OF BOOKS.

Third Annual Report of the Director of the Imperial Mint, Osaka, Japan, for the Year ending July 31st, 1874.
Hiogo: "Hiogo News" Office.

THIS report is mainly interesting from the light it throws upon the progress of chemistry and metallurgy in Japan. The chemists, engineers, assayers, engravers, &c., appear still to be all Englishmen. From the special memorandum of the chemist, Mr. Gowland, we gather some interesting facts as to Japanese copper. The following analysis is given to show the composition of an average crude copper from Washiu:—

Copper..	..	..	..	98.940
Lead ..	..	..	..	trace
Sulphur ..	..	..	..	0.947
Iron ..	..	..	..	0.101
Silver ..	..	..	..	trace
Arsenic ..	..	..	..	trace
Antimony ..	..	..	..	absent

99.988

A sample from Hishiu is remarkable for the abnormal amount of lead:—

Copper..	..	..	..	58.872
Lead ..	..	..	..	39.283
Silver ..	..	..	..	0.185
Iron ..	..	..	..	0.083
Sulphur ..	..	..	..	1.635
Arsenic ..	..	..	..	faint trace
Antimony ..	..	..	..	absent

100.058

All the samples of copper examined were remarkably free from the specially injurious metals, antimony and arsenic, antimony being present only in one specimen, and then only in faint traces, whilst the maximum amount of arsenic only reached 0.057 per cent, and in thirty-one cases (out of 38) it was either absent altogether, or the merest traces only were found." Mr. Gowland very justly remarks that the copper of Japan, when properly selected and refined, should be of high value for electro-telegraphic purposes, where freedom from arsenic and antimony is especially required, these metals when present reducing the electro conductivity to a serious extent."

Many of the native copper ores are argentiferous, and silver is present in the metal in more than traces, though the greater proportion of the precious metal is removed by a "crude process of liquation with lead."

An ingot of so-called native gold was received by the department for examination. It consisted of:—

Gold ..	..	..	..	78.50
Silver ..	..	..	..	12.25
Lead ..	..	..	..	8.05

Copper, with smaller proportions of arsenic and antimony, were also present. The metal was "of a dull, dirty greenish-yellow colour, excessively brittle, and with a fracture almost earthy, of the colour of that of Muntz's metal. From this ingot the gold and silver were successfully extracted in a state fit for coinage by Miller's chlorine process.

Plumbago of good quality is found at Satsuma. A sample analysed contained 88.09 carbon, and 11.01 of a pale grey ash.

Our countrymen in the service of the Imperial Japanese Mint appear to be decidedly the right men in the right place, and as such we wish them every success.

Practical Guide to the Determination of Minerals by the Blowpipe. By Dr. C. W. C. FUCHS. Translated and Edited by T. W. DANBY. London: Field and Tuer. Philadelphia: Claxton, Remsen, and Haffelfinger.

THIS work, as the author informs us in his preface, consists of two parts, the one treating of the determination of minerals by the blowpipe; the other explaining means of determining crystallised specimens, depending upon their physical characteristics. The translator's object has been "to present Prof. Fuchs's treatise so that it shall be in the highest degree serviceable, not only to the student of mineralogical science, but also to the less purely scientific investigator, in the mine or the quarry." In place of the second part of the original German work "is appended a table, showing the hardness, specific gravity, and crystallographic system of each species, so far as these latter are determined beyond question."

The editor points out, among the obstacles which present themselves to any one either writing or reading a work of this nature, "the perplexities of chemical nomenclature and notation, and the bewildering abundance of synonyms." The latter point, which has recently been the subject of some correspondence in our columns, he pronounces "a disadvantage well nigh as grievous as that due to vagaries in chemical notation." Valuable, or rather indispensable as formulæ are in works dealing with chemical theories, their legitimate place in manuals of analysis is very small, and we regret the manner in which they are too often needlessly paraded.

The following hint may prove useful: "When the quantity of substance to be reduced is very small, the end of a wooden lucifer match will be found a convenient support. The end of the match is smeared with sodium carbonate, and charred by careful exposure to the flame. A small charcoal point coated with soda is thus obtained, the moistened assay can be readily affixed to this, and held in any required position in the flame."

Of course a treatise of such brief compass—some eighty pages—cannot be expected to "supersede or compete with" such works as that of Plattner. But within the limits which the author and the translator point out, it will, we believe, be found useful by students and travellers interested in mineralogy.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 14, April 12, 1875.

New Body Found in the Urine after the Ingestion of Chloral Hydrate.—MM. Musculus and de Mermé.—Foreign substances introduced into the human organism are rejected in states which may be divided into three groups:—1. Bodies which pass unaltered through the system, such as creatin, acetamid, &c., and are found unchanged in the urine. 2. Bodies which are decomposed, and whose decomposition products are found in the blood, the saliva, and the urine, such as leucin and glycocoll, which yield urea. 3. Bodies which combine chemically with some product of the organism, and thus pass into the urine. The type of this group is benzoic acid, which combines with glycocoll, and is eliminated as hippuric acid. In the urine of dogs poisoned with chloral hydrate, Feltz and Ritter have recently discovered chloral, sugar, and another organic substance precipitable by the basic acetate of lead. It is an acid which forms stellar groups of crystals resembling those of tyrosin, and containing—

Carbon	31.60
Hydrogen	4.36
Chlorine	26.70

It is not expelled from its salts by acetic acid. At the boiling-point it reduces alkaline solutions of copper and bismuth, and salts of silver, and decolourises sulphate of indigo. It turns the plane of polarisation to the left. The authors hold that chloral should rank in the third group with benzoic acid, and propose for the acid found the provisional name of urochloralic.

Inaccuracy of Determinations of Nitrogen in Manures.—A. Bobierre.

Calorimetric Study on the Carbides of Iron and of Manganese.—MM. Troost and Hautefeuille.—These experiments show—That carburetted irons are formed with absorption of heat, if we set out from their elements. This fact classifies cast-irons in the category of the explosives, or in that of solutions. That manganese and carbon combine with the disengagement of much heat. In this respect the carbide of manganese, Mn_3C , is comparable to the most stable compounds of mineral chemistry. The combinations of iron, manganese, and carbon are also attended with great disengagement of heat. The ferromanganeses, therefore, are true compounds.

Matters Optically Active, and Distinct from Glucose, Normally Present in Wine.—M. A. Béchamp.—Wine decolourised, suitably concentrated, and freed from tartar, yields a solution which, in some cases, turns the plane of polarisation to the left, in some to the right, and in others occasions no deviation. When it turns to the left it is because the quantity of non-crystalline sugar is more than

sufficient to compensate for the effect of the dextro-gyratory matters. When it turns to the right, the quantity of lævulose is too small to compensate the action of the dextro-gyratory matters, or else it has been entirely destroyed. If there is no deviation, the dextro-gyratory matters are exactly compensated by the lævulose, or all the active matters have disappeared. Neither the saccharimeter nor the cupro-potassic reagent are safe processes for the determination of the sugar in wines. Hence, fermentation alone appears trustworthy.

Preparation of Perchlorated Ethylen.—E. Bourgoin.—The process of Geuther does not give satisfactory results. The following procedure is simple, easy, and successful:—Dissolve with the aid of heat sesquichloride of carbon in double its weight of commercial aniline. Heat the mixture in a retort to 170° , and collect the product which distils slowly into a receiver, which scarcely requires to be cooled. The action commences immediately, and the liquid takes rapidly a fine red colour. A quantity of 500 grms. requires about six hours. The distillate is perchlorinated ethylen, holding in solution aniline and sesquichloride of carbon. To remove the latter body, an equal weight of aniline is added, and the whole is distilled between 130° and 145° . By means of washing with dilute sulphuric acid the residue of aniline is easily removed. All that is requisite is to dry the product over fused chloride of calcium.

Amount of Heat Liberated in the Decomposition of the Bromides of Certain Acids of the Fatty Series by Water.—M. W. Louguinine.—Not suitable for abstraction.

Determination of Carbonic Acid in the Air, on board the Balloon "Zenith."—M. G. Tissandier.—At the altitude of 800 to 890 metres, at the temperature of 0° , and the pressure of 760 m.m., the amount of carbonic acid in 10,000 parts was 2.40. At 1000 metres the proportion was 3.00. These differences are within the limits of variation of experiments made on the surface of the earth.

Central-Blatt für Agrikultur Chemie,
Heft 2, February, 1875.

Formation of Nitrous Acid and Peroxide of Hydrogen in Nature.—Prof. L. Carius.—From *Liebig's Annalen*, 174, pp. 1 and 31.

Temperature of the Greatest Density of Water.—F. Exner.—The mean result obtained by the author is 3.945 , which agrees with Joule and Playfair's determination.

Regulating the Amount of Water in Cultivated Lands.—Dr. A. Schleh.—The author finds that a soil when rolled or otherwise solidified by pressure, loses by far more water than one whose upper surface is loosened.

Phosphate of Lime of Ciply, in Belgium.—Ninoit.—The nodules contain, on the average,—

Water	} 25.55
Organic matter	
Carbonic acid	
Sand and clay	1.30
Phosphoric acid	20.35
Sulphuric acid	0.12
Chlorine	0.25
Fluor	0.18
Lime	51.60
Oxide of iron	0.90

The grey limestone, interspersed with small brown granules, gave—

Loss on ignition	31.00
Sand and clay	2.10
Phosphoric acid	11.13
Lime	54.00
Chlorine	—
Oxide of iron	1.16
Not determined, and loss ..	0.67

Analysis of Buffalo's Bones.—J. W. Mallet.—From the CHEMICAL NEWS.

Comparative Experiments with Peruvian Guano and Mono-Phospho-Guano.—Faron.—The Peruvian guano gave a greater weight, both of corn and straw. The soil is described as poor and calcareous. The composition of the mono-phospho-guano is not given.

Comparative Manurial Experiments on the Experimental Field at Giessen.—Prof. Thaer.—The manures tried were—(1) Ohlendorff's dissolved guano, guaranteed to contain "9 to 10 per cent easily soluble phosphoric acid," and the same amount of "nitrogen secured against evaporation." (2) Steamed bone-dust, from Griesheim's works, at Frankfurt, guaranteed as containing 20 to 22 per cent of phosphoric acid. A plot manured with 100 lbs. guano yielded a heavier crop than an equal plot manured with 200 lbs. bone-dust.

Investigations on the Production of Heat, and the Transformation of Matter in Animals.—Dr. H. Senator.

Source of the Acid in the Gastric Juice.—R. Maly.—From *Liebig's Annalen*, 173, p. 227.

Pancreatic Peptones.—Dr. B. Kistiakowsky.

Consumption of Food, and the Productivity of German and French Rabbits.—Dr. H. Weiske.

Influence of the Cultivation of Meadows on the Nutritive Value of Hay.—"E."

Feeding Calves.—H. Bertshinger.

Evaporation from Certain Organs of Plants.—Dr. A. Schleh.—The author shows that a considerable amount of water escapes from the roots of plants.

What Degree of Heat can Seed-Wheat bear without becoming Incapable of Germination?—F. Krasan.—If moisture has been previously expelled, the temperature required for the complete destruction of the germinating power is higher than 100°.

Occurrence of Alumina in Cryptogamous Plants.—A. H. Church.—From the CHEMICAL NEWS.

Comparative Cultivation of Barley and Rye.—Dr. L. Wittmarch, Prof. F. Körnicke, Dr. Crampe, &c.

How Thickly, and in what Manner Rye should be Sown.—E. Schwarz.

Attempt at Acclimatising Media Sativa on the Sandy Soils of the Coast of Flanders.—J. Landron.

Is it Possible to Produce a Beet-Seed which shall both yield a Heavy Crop and a High Percentage of Sugar?

Experiments with Beet-Root in Ireland.—Dr. Cameron.—From a pamphlet by the author.

Intensity of the Inversion of Sugar by various Mineral and Organic Acids.—Dr. Arno Behr.—It is well known that dextro-rotatory cane-sugar is more or less readily inverted under the influence of certain acids, becomes converted into a mixture of dextro-rotatory glucose and lævo-rotatory fructose. The author has made a series of comparative experiments on the action of various acids upon cane-sugar. The principal points examined were the respective proportions of sugar and acid; the degree of concentration; the time of action; the temperature; and the chemical nature of the acid. Each of these points was varied in turn in the several series of experiments, whilst the others were kept constant. All the acids examined produced inversion, namely, the acetic, butyric, isobutyric, malic, citric, succinic, formic, lactic, tartaric, oxalic, phosphoric, sulphuric, hydrochloric, and nitric. The action is very trifling near the temperature of 0°, rises not proportionately to the temperature, and becomes suddenly very powerful at a temperature lying between narrow limits, which vary according to the nature of the acid. According to their degree of action at common temperatures, the acids may be arranged in a series in which nitric and hydrochloric acids appear the

most powerful, and the volatile acids of the fatty series (except formic acid) the least so. A similar series is found by taking the temperatures at which the comparably strong action of the acids begins. For the acid washing-water in Scheibler's process acetic acid is most suitable for beet-root, and sulphuric for Colonial sugars. No simple connection was found between the chemical nature of the acid and the intensity of the inversion.

Use of Zinc in Breweries.—Prof. J. Nessler.—Zinc is slowly acted upon by worts and by decoction of hops.

Coagulation of Milk.—Prof. Segelke.

Peculiar Goat's Milk.—Dr. G. Schröder.

Preservation of Articles of Food.—Prof. A. Almen, Tellier, and Poggiale.

Smoked Meats.—Prof. J. Nessler.—The author shows that the real preservative of smoked meats is dryness.

Need of Bacteria for Oxygen.—Prof. F. Cohn.—The author holds that the bacteria found in Dr. Bastian's well known experiment were pre-existent in the cheese employed as germs, which the boiling was not sufficiently prolonged to destroy.

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Gazzetta Chimica Italiana, Anno v., Fascicolo 1 and 2, 1875.

Notice of Two New Derivatives of Phloretic Acid.—W. Kœner and P. Corbetta.—The authors describe methyl- and ethyl-phloretic acids, and their oxidation-products.

Origin of the Sulphides and Hyposulphites found in Sulphuretted Springs.—Prof. Egidio Pollacci.—The author concludes that the alkaline and alkaline-earthly sulphides found in nature, and especially in sulphuretted waters, instead of being derived from the reduction of sulphates, as was believed till lately, are produced by the action of hydrosulphuric acid upon carbonates and silicates. These sulphides, then, attracting oxygen from the air, are converted first into polysulphides, and then into hyposulphites. The opalescence of the sulphur-waters of the French Pyrenees is mainly due to silicic acid, derived from the action of carbonic or hydro-sulphuric acid upon the silicates in the water.

Researches on Certain Derivatives of Thymol, Natural and Synthetic.—E. Paterno.—The bodies examined are the acetylic derivative of thymol,—



the methylic ether, $\text{C}_{10}\text{H}_{13}\text{OCH}_3$; the ethylenic derivative; the sulph-acid of the methylic ether, with its barytic, plumbic, and potassic salts. Of the derivatives of cymen-thymol, the author has examined the acetylic derivative; the methylic and ethylenic ethers; the sulph-acid of the methylic ether, with its barytic salt; and the sulph-acid of cymen-thymol.

Paratoluylic Nitrile and some of its Derivatives.—E. Paterno and P. Spica.—The authors, by passing a current of sulphuretted hydrogen into the alcoholic solution of paratoluylic nitrile, obtain paratoluylic sulph-amide.

Glucosate of Copper.—Dr. M. Fileti.—The compound contains 47.36 per cent of copper, and may be expressed by the formula $\text{C}_6\text{H}_6\text{O}_6\text{Cu}_32\text{H}_2\text{O}$.

Experiments on the Production of Cymen-Carbonic Acid.—E. Paterno and M. Fileti.—The authors have obtained a substance which they consider to be the amide of cymen-carbonic acid.

Supposed Emission of Carbonic Acid from the Roots of Plants.—M. Mercadante and E. Colosi.—The authors conclude that the evolution of carbonic acid from roots is not an admissible fact.

—
Moniteur Scientifique, du Dr. Quesneville,
February, 1875.

Copper-Ruby as a Colour for Glass.—M. Paul Ebell.—A most important treatise, but unfit for abstraction,

Relations of Fluorescence between Chrysen and Pyren.—H. Morton.—Translated from the *Transactions of the Stevens's Institute of Technology*.

Analysis of Industrial Products.—M. A. G. Pouchet.—A paper on alkalimetry.

Chemical Products at the Exhibition of Vienna.—M. E. Kopp.—An account of the oily and fatty bodies, soaps, &c.

Remarks on the Properties of Nitrate of Methyl.—M. C. Girard.—This paper has already appeared in the CHEMICAL NEWS.

Modification of Rivot's Process for the Determination of Copper as Sulphocyanide.—M. A. Ferent.—Noticed elsewhere.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved process for treating blood for the manufacture of manure. Thomas Myerson, St. John's Street, Clerkenwell, Middlesex. June 30, 1874.—No. 2273. The feature of novelty in this invention consists in mixing chloride of sodium and alum with blood, and drying in the common atmosphere, thereby retaining the natural proportions of nitrogen contained in the blood for the manufacture of manure.

Rendering steel and iron wares incorrodible. James Alfred Briggs, Wellington Street, Middlesex, and George Mutlow Abell, Gloucester. July 3, 1874.—No. 2319. The application to the steel and iron wares of the scientific process or processes for rendering in iron the state technically known as the passive state, with the object of rendering them incorrodible.

Improvements in the manufacture of blue colouring matter. Edouard George Peter Thomas, Star Chemical Works, Brentford, Middlesex. (A communication from Charles Adam Girard, Rue des Ecoles, Paris.) July 4, 1874.—No. 2347. This Provisional Specification describes heating one or more of the tertiary monamines, methyl-diphenylamin, ethyl-diphenylamin, and amyl-diphenylamin with oxalic acid. The Specification also describes purifying the blue colouring matter so produced.

Improvements in the process of and apparatus for reducing ores of manganese and other metallic oxides. Jonathan Ireland, jun., Edward Street, Broughton Lane, Manchester, Lancaster. July 8, 1874.—No. 2395. This invention relates to the reduction of ores of manganese and other metallic oxides to a condition of spongy metal by feeding a mixture of ore with carbonaceous matter into an annular passage at the top of a reducing vessel, and allowing it to descend by gravity along the vessel, subject for a certain distance to the heat of an annular flue, in which there is a combustion of gas and air admitted by side apertures, and for a further distance to the cooling action of an iron casing water jacketed, the metallic sponge being removed from time to time in portions through a door at the bottom of the casing.

Improved means or method of treating and clarifying impure or waste water from fulling mills, scouring mills, or scouring processes, dyehouses, sewage, or other impure waters. Samuel Hallsworth, Armley, near Leeds, and Richard Bailes, Woodhouse Carr, Leeds, York. July 9, 1874.—No. 2408. The employment of bisulphate of iron, or sulphuric acid and iron, or sulphuric acid and mother-liquor from the crystallisation of copperas, for effecting the sediment of the impurities after agitation.

An improved method of and apparatus for disinfecting and deodorising the injurious gases arising from sewers and drains. Frederick Dixon, surgeon, Cliftonville, Brighton, Sussex. July 9, 1874.—No. 2409. The object of this invention is to effectually disinfect and deodorise the gases given off at the ventilating shafts, or other openings of sewers and drains, by causing such gases to pass through flannel, cloth, sponge, or other porous material saturated with a disinfectant or deodoriser, the flannel or other material being fitted in a suitable apparatus.

Improvements in treating sewage water and other foul liquids for the purpose of purification, and in the manufacture of manure. Edward Augustus Schmiersahl, manufacturing chemist, Manchester, Lancaster. July 11, 1874.—No. 2439. The features of novelty in this invention consist in treating sewage water and other foul liquids with a mixture of about 2 parts diluted sulphuric acid and 1 part of hydrochloric acid, or with phospho-muriate of lime, commonly called bone liquor, or with chloride of manganese, and then adding sufficient milk-lime to the sewage to neutralise the acid. Besides purifying the liquid, a precipitate is thus formed, which may be used alone as manure, or be added to other manurial agents in the manufacture of manure.

An improved process for treating sewage and for utilising certain products derived therefrom, which improvements are partly applicable to other purposes. William Alexander Lyttle, engineer, The Grove, Hammersmith, Middlesex. July 13, 1874.—No. 2446. The features of novelty are as follows:—First. The utilisation of the sedimentary matter or "sludge" of sewage in the smelting of iron, the carbonaceous matter and the silicates of the sludge being made to serve in various ways as auxiliary to the fuel and fluxing materials now employed. Second. The consolidation of the "duff," or colliery dust of coal, or the dust of peat charcoal, by incorporating sludge with such dust, and

then making the mixture into lumps for smelting fuel. Third. The consolidation in the last-mentioned way of a mixture of crushed iron ore, lime, sand, powdered fuel, and sludge, so as to make a conglomerate containing in itself all the materials of a smelting-furnace charge. Fourth. The filtration of the effluent water of sewage through a "vortex filter," consisting of charcoal kept in slow movement by a pug-mill arrangement. Fifth. The recovery of ammoniacal liquor from the exhausted charcoal of this filter by coking. Sixth. The use of the charcoal in the first instance for filtering the drinking-water supplied to a town before such charcoal is used for sewage purposes.

Improvements in the recovery of carbonate of ammonia from sewage. Major-General Henry Young Darracott Scott, C.B., Ealing, Middlesex. July 13, 1874.—No. 2450. The patentee commences operations, as a ready means of arriving at the compound required, by employing calcined magnesite or magnesia produced in any other way, to which has been added such a quantity only of phosphoric acid or soluble phosphate, or phosphate dissolved in mineral acids, as will leave the magnesia in considerable excess.

A new or improved antiseptic fertiliser. William Edward Newton, civil engineer, Chancery Lane, Middlesex. (A communication from Robert Augustus Cheseborough, New York, U.S.A.) July 13, 1874.—No. 2451. The invention consists of a new antiseptic fertiliser, composed in part or in whole of a combination of bone-black and hydrocarbon oil.

Improvements in the treatment of urine and liquid sewage in order to fix the azote and phosphate substances contained therein, and convert them into solid matter, and in apparatus for the same. William Spence, patent agent, Quality Court, Chancery Lane, Middlesex. (A communication from Emile Seraphin Joseph Forgeois and Victor Louis Claye, both of Paris.) July 14, 1874.—No. 2461. The liquid sewage and faecal matter are passed without filtration into a series of receptacles placed at successively lower levels, in which receptacles the material, after being mixed with acid and well stirred, is gradually dried. The product is a material containing in a fixed but soluble state all the azote and phosphorus contained in the original matter, but retaining the richest ingredients for manure.

Improvements in the manufacture of artificial stone for buildings, floors, and other purposes. James O'Friel, Brooklyn, New York, U.S.A. July 16, 1874.—No. 2500. This invention has for its object a cement which will resist great cold. I first make a cement composed of lime 55 parts, alumina 8 parts, silica 24 parts, potash of soda 3 parts, water glass in solution 10 parts. The above is allowed to set, and when required for use I make a composition as follows:—3 parts of clean sharp silix or sand mixed with 3 parts of cement when dry, and then wet them with an aqueous solution of liquid glass.

MEETINGS FOR THE WEEK.

TUESDAY 18th.—Civil Engineers, 8.

— Zoological, 8.30.

— Royal Institution, 3. Prof. Gladstone, "On Chemical Force."

WEDNESDAY, 19th.—Society of Arts, 8.

— Pharmaceutical, 11. (Anniversary).

— Meteorological, 7.

THURSDAY, 20th.—Chemical, 8. "Notes on Milk, in Health and Disease," by A. H. Smeë, jun.; "On the Effects of Pressure and Cold upon the Gaseous Products of the Distillation of Carbonaceous Shales," by J. J. Coleman; "On some Nova Scotian Triassic Trap Minerals," by Prof. How; "On some Points in the Examination of Waters by the Ammonia Method," by W. H. Deering; "On the Agricultural Chemistry of the Tea Plantations of India," by Dr. Campbell Brown; "On the Structure and Composition of Certain Pseudomorphous Crystals, having the Form of Orthoclase," by J. A. Phillips; "On Nitrosyl Bromide, and on Sulphur Bromide," by M. M. Patison Muir.

— Royal Institution, 3. Prof. Dewar, "On the Progress of Physico-Chemical Inquiry."

— London Institution, 7.

FRIDAY, 21st.—Royal Institution, 8, Weekly Evening Meeting. Mr. J. Baillie Hamilton, "On the Application of Wind to Stringed Instruments," 9.

SATURDAY, 22nd.—Royal Institution, 3. Mr. W. H. Pollock, "On the Drama."

— Physical, 3. Mr. H. Bauermann, "On the Electric Conductivity of Anthracite Coal." Mr. W. Spottiswoode, F.R.S., "On a Revolving Polarising Scope." Mr. E. J. Mills, F.A.S., "On Fusion-Points and Thermometry."

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THE CHEMICAL NEWS.

VOL. XXXI. No. 808.

THE RIVERS' POLLUTION BILL.

THE London correspondent of an eminent German scientific journal a short time ago characterised the ruling powers of England—quite irrespective of party supremacy—as “a government very unfavourable to science and to her followers.”* This censure is decidedly justified by the sanitary measures of the present administration. The “Adulteration of Food and Drugs Bill” insults science by subjecting the results of chemists of high professional standing and European celebrity to revision by a body of men of whose very existence the intellectual world is scarcely aware. The Bill now under our consideration, if it does not treat chemistry with formal contumely, ignores her very existence. We were always of opinion that the pollution of rivers was essentially a chemical question. The proposed law shows that Her Majesty's advisers are of a different conviction.

The Bill prohibits the introduction into streams and rivers of “filthy, poisonous, noxious, or polluting” liquids. But who is to decide on the application of these terms? One person—interested possibly in the preservation of fisheries, or in the beauty of a stream flowing through his estate—may extend them to any outfall less pure than distilled water. Another—solicitous chiefly for the easy management of a dye or chemical works—may think such epithets too harsh for the liquid refuse of his establishment. Here, therefore, is already the scope for a “very pretty quarrel.”

We are of course duly thankful that the “recommendations” of the late Rivers' Pollution Commissioners are ignored by the Bill, as they have been by the majority of judicious and impartial critics. We have denounced these recommendations, not so much on account of their stringency as of their inconsistency, and of their radically false point of view; and we are, therefore, in the language of Sterne, well content to “wipe them up and say no more about them.” But the present Bill takes account neither of the composition—qualitative or quantitative—of matters entering a stream, nor of the proportion they bear to its waters, nor of the state of the river itself: points which ought to be decided by chemical and physical examination it leaves to the vague impressions of the general public. We further read in the Bill that all persons are to use “the best practicable and available means to detain or render harmless” the filthy liquids falling into any stream. But who is to decide what means are, in any particular case, the “best practicable and available”? On this head we know that doctors—not to speak of charlatans—differ.

Returning to the Bill, we find that a municipal corporation or local board may continue to run sewage into any river, if the best available means for its purification have been adopted. The same may be done, under the same conditions, by a manufacturer or mine-owner, if he has been at work for twelve years or upwards. But if he has been polluting a river for less than twelve years, such manufacturer or mine-owner, whatever means he uses for purifying his liquid refuse, enjoys immunity for two years only. What he is to do hereafter does not appear. We must confess that we see little reason for so arbitrary a distinction.

Again, it has been generally suggested—and in some respects it has been positively enacted—that certain kinds of manufacturing refuse should be kept entirely out of town sewers, and dealt with separately. Our readers will easily call to mind substances which if once mixed with sewage must prove a formidable, if not insurmountable,

* “Eine der Wissenschaft und ihren jüngern sehr abhold gesinnten Regierung.”

obstacle to its utilisation in agriculture, whether by way of irrigation or precipitation. Under this Bill even the residual liquors from india-rubber works and petroleum refuse are to be admitted.

“Saving clauses”—an irreverent friend of ours applies to them an adjective of diametrically opposite meaning—are generally appended to an Act of Parliament lest it should prove too efficacious. The custom has been duly observed in this case. A proviso of that kind exempts the metropolis from the operation of the Act. Consequently, not merely will the sixty sewers which still pour their filthy waters into Father Thames within the metropolitan district be permitted to flow on unchecked, but the gigantic pollutions of Barking and Crossness—dear to engineers in one sense, and to ratepayers in another—are not to be “affected.” Why the Metropolitan Board of Works should be thus exceptionally privileged, in contrast to the corporations of Liverpool, Dublin, Glasgow, Manchester, Leeds, &c., is difficult to imagine. Perhaps the very magnitude of the offence makes filth—like murder and robbery—respectable.

We can scarcely pronounce this Bill a specimen of the vigorous sanitary legislation which we expected from the present administration. It shows, indeed, good intentions, but they, as we know, oft-times pave a way upon which it is not profitable to travel.

REPORT ON THE DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from page 204).

UP to this time, the following methods of preparation were either in use, or had been proposed:—The original process of Priestley, heating oxide of mercury, of course, the most expensive, and the least suited for technological purposes; then Scheele's method, treatment of peroxide of manganese with sulphuric acid, the result being manganous sulphate and oxygen. On the large scale, since the investigations of Berthier in 1822, this was replaced by the simple ignition of manganese, and finally the action of heat upon the chlorate of potash. The last-mentioned process, in spite of its costliness, has become established for laboratory operations, as being convenient and requiring only a small supply of heat, although it has frequently occasioned explosions when the gas was being too rapidly liberated. To prevent such accidents, it has been repeatedly proposed to mix manganese with the chlorate of potash. Recent accidents, especially a fearful explosion in a pharmaceutical laboratory in Paris, induced Debray and Bourgoin† to make known the precautions used in Deville's laboratory. Manganese, or the red manganoso-manganic oxide (Mn_3O_4), which is more easily obtained in a state of purity, is mixed with the chlorate of potash in equal weights, and the iron retort is heated in a furnace filled with fuel in such a manner that the fire may be kindled at the top. Schwartz‡ made known accidents occasioned by the use of manganese adulterated with lamp-black, or by the accidental use of the sulphide of antimony instead of manganese, and he therefore very justly recommends that oxygen gas mixture should be previously tested by heating a portion upon platinum foil. Munck|| proposed to use oxide of iron instead of manganese, as being more easily distinguished.

Scheele's process—the mutual action of manganese and sulphuric acid—has the disadvantage that the glass is often broken by the congelation of the manganous sulphate. To prevent this, Wagner§ proposes to use, instead

* “Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends.”

† Debray and Bourgoin, *Ber. Chem. Ges. zu Berlin*, 1870, 240.

‡ Schwartz, *Breslauer Gewerbeblatt*, 1865, 7.

|| Munck, *Pohl's Lehrbuch der Technologie Wein*, 1865, 186.

§ Wagner, *Fahresberichte*, 1866, 198.

of sulphuric acid, bisulphate of soda. An easily fusible double salt is thus formed which does not break the glass as it cools. Pure peroxide of manganese, when thus treated, evolves 18 per cent of oxygen, but only 12 per cent if ignited, when it is converted into sesquioxide. Nevertheless, the latter process is the more economical. Deville and Debray* calculate the expense according to the source of the manganese, as follows:—

Ten kilos. of Manganese from	Cost. Francs.	Price of 1 cubic metre of O. Francs.
Romanèche	10	4.86
Spain	16	3.45
Pyrenees	18	3.86
Giessen	27	4.87
Italy	40	5.98

The trifling value of the residual sesquioxide which contains iron, and is therefore useless in the glass manufacture, is not taken into account. This calculation dates from the time when the re-oxidation of manganese was still an unsolved problem. If the price of oxygen obtained from manganese ranges from 3.45 to 5.98 francs it is cheaper by more than one-half than that procured from chlorate of potash, which Dupré† calculates at 10 francs.

Deville and Debray‡ found a much cheaper source in sulphuric acid, which, at elevated temperatures, is resolved into water, sulphurous acid and water. Retorts containing 5 litres of very infusible glass were partially filled with platinum foil, or with fragments of brick, and heated to redness, whilst sulphuric acid was allowed to flow in in a slender stream. The escaping gases are led through a cooling apparatus in order to condense sulphuric acid, and into water to remove sulphurous acid. By this process 2.436 kilos. of sulphuric acid of the sp. gr. 1.827 yielded 240 litres of oxygen at the expence of 1 franc per cubic metre. On its application the cost of smelting platinum was from 20 to 30 centimes per kilo.

According to a paragraph by Moigno|| the firm of José de Susine and Co., of Paris, prepared by this process oxygen at 0.85 franc per cubic metre, re-converting the sulphurous acid into sulphuric acid.

Instead of the free acid Deville and Debray propose the use of sulphate of zinc; 100 kilos. of the anhydrous salt yielded in their experiments 6.8 cubic metres of oxygen, —far more than the best black oxide of manganese—22 kilos. sulphurous acid gas, and 51 kilos. oxide of zinc.

(To be continued).

VOLUMETRIC ESTIMATION OF ZINC.

By F. MAXWELL LYTE, F.C.S.

SOME advantage will be found by the employment of a uranic salt as an indicator in the estimation of zinc volumetrically, by means of ferrocyanide. The zinc should be in solution, in hydric chloride by preference, and the solution should be pretty strongly acid. Iron or copper should not be present, nor should nickel or cobalt.

When a solution of zinc in hydric chloride is heated to 80° or 100° C., rendered pretty strongly acid, and a drop or two of uranic acetate added, and then a solution of potassium ferrocyanide run in from a burette, a brown spot of uranic ferrocyanide forms where the potassium ferrocyanide falls, but disappears on stirring so long as a trace of zinc remains unprecipitated; but the moment all the zinc has become converted into ferrocyanide, the next drop or so of potassium ferrocyanide tinges the whole liquid brown. I prefer, in practice, not only adding a trace of uranic acetate to the zinc solution, but at the

same time—at the end of the operation—trying a drop of the zinc solution on a white porcelain plate, with a glass rod moistened with the uranic salt. The reaction seems to me in this case slightly more delicate, while the operator is warned of the approach of the termination by the fact that the brown colour in the liquid disappears rather more slowly towards the end of the operation.

EXAMPLE.

Estimation of Zinc in a Sample of Plumbiferous Blende.
—Two grammes of the finely-pulverised ore were boiled in a porcelain capsule, covered with an inverted glass funnel, with strong hydric chloride. The solution was decanted into another capsule, and the residue boiled again with fresh hydric chloride, a few crystals of potassic chlorate being added towards the end of the operation. The first liquid was now returned to the capsule from which it had been poured, and mixed with the second solution and the siliceous residue, and the whole was evaporated to a small bulk with a further addition—if requisite—of a few more crystals of potassic chlorate, to ensure the complete peroxidation of all the iron. The contents of the capsule were now washed out into a beaker glass, and a cream of barium carbonate in water poured into the liquid, in quantity sufficient to precipitate all the iron. After standing in the cold for about four or five hours, the liquid was separated by filtration, and, the residue being washed on the filter, the liquid was introduced into a measured flask of 200 c.c. capacity, about 10 c.c. of strong hydric chloride were added, and, lastly, water to make up the bulk of the liquid to 200 c.c.

The potassic ferrocyanide solution is made by dissolving 43.2 grms. of the purified, re-crystallised, dry salt in water, and making up the bulk to 1 litre. Such a solution corresponds, bulk for bulk, with one containing 10 grms. of pure zinc dissolved in hydric chloride, and the solution made up to 1 litre capacity. Consequently 1 c.c. of the said ferrocyanide solution corresponds to 0.01 gm. of zinc.

Twenty c.c. of the zinc solution derived from the 2 grms. of blende were now taken, and placed in a small beaker glass, with about their bulk of water and 3 drops of a solution of uranic acetate, and the beaker was heated in a small steam-bath to nearly boiling, and the ferrocyanide solution run in. As soon as 70 c.c. had been added, the brown stain produced in the solution was seen to disappear more slowly after each addition. A few drops of uranic acetate were now placed separately on a white plate, and the ferrocyanide being only added a drop or two at a time to the zinc solution, it was observed that the admixture of a drop from the beaker with one of the drops on the plate produced the barest possible commencement of discolouration when 73 c.c. of ferrocyanide had been added. Deducting 0.2 c.c. for the quantity of ferrocyanide which was necessary to produce the colouration (for an excess was of course necessary), we have 72.8 c.c. as the quantity employed for the precipitation of the zinc contained in 20 c.c. of the liquid—i.e., in 0.2 gm. of the blende; but each 1 c.c. of the ferrocyanide is equivalent to 0.01 gm. of zinc,—therefore we have $36.4 \times 0.01 \times 100$ = the percentage of zinc contained in the sample.

The sample in question contained about 2.7 per cent of copper, but the copper was precipitated with the iron by the barium carbonate. Had it been in greater excess it might have been necessary to precipitate it as subsulphocyanide before titration by the ferrocyanide.

The advantages of my method are—

1. That the zinc may be estimated directly in the solution of the chloride, as it almost always occurs in analyses.
2. That the end of the operation can be more exactly and readily perceived with the uranic indicator than with any other reagent I know of.

Laboratoire, 6, Cité de Retiro, Faubg. St. Honoré,
Paris, May 10, 1875.

* Deville and Debray, *Comptes Rendus*, li., 822.

† Dupré, *Compt. Rend.*, lv., 736.

‡ Deville and Debray, *Compt. Rend.*, li., 822.

|| *Les Mondes*, 1867, p. 494.

NOTE ON SILVER ALUM.

By A. H. CHURCH.

ELEVEN years ago I described in the CHEMICAL NEWS, (vol. ix., 1864, p. 155) the preparation of silver alum by heating in a sealed tube equivalents of silver sulphate and aluminium sulphate with a quantity of water insufficient to dissolve the former salt at 100° C. Had Mr. Sergius Kern looked into the *Jahresbericht der Chemie* for 1864, p. 286, he would have found his description in this week's CHEMICAL NEWS of the composition, preparation, and properties of silver alum anticipated by the ninth part of a century!

May 15, 1875.

NOTES UPON SUGAR ANALYSIS.

By G. C. STEWART, F.C.S.,

Greenock.

(Concluded from page 213.)

Estimation of the Non-Crystallisable Sugar.—This is best done volumetrically, after Fehling. He prepares a standard solution of "copper-liquor," by dissolving 34.639 grms. of chemically pure cupric sulphate in 200 c.c. of water, and 173 grms. of Rochelle salts in 480 c.c. of solution of caustic soda (1.14 sp. gr.), and dilutes the two solutions, when mixed, to 1 litre, by volume, with water. Ten c.c. of this solution contain 0.34639 gm. cupric sulphate, and correspond exactly to 0.05 gm. *anhydrous grape sugar*. The solution, thus prepared, is standardised against a standard solution of grape sugar, containing 0.5 gm. in 100 c.c. of water.

Expt. 1.—Fehling's solution was prepared by dissolving 12.1378 grms. of cupric sulphate in 100 c.c. of water, 60.61 grms. of Rochelle salts in 168.19 c.c. of solution of caustic soda (1.14 sp. gr.), and the mixed solutions were diluted with water to 350.4 c.c.

(b). The standard solution of grape sugar was prepared by dissolving 0.7404 gm. in 100 c.c. of water.

Upon titration, 10 c.c. of "copper-liquor" demanded 6.5 c.c. of the sugar solution to reduce all the oxide to the state of suboxide. But this *volume* of sugar solution contains 0.0481 gm. of grape sugar.

	Theory.	Practice.
10 c.c. of "copper-liquor" =	0.050	0.048

Expt. 2.—Fehling's solution was prepared by dissolving 10.1146 grms. of cupric sulphate in 100 c.c. of water, 50.516 grms. of Rochelle salts in 140.16 c.c. of solution of caustic soda (1.14 sp. gr.), and the mixed solutions were diluted with water to 292 c.c.

(b). The standard solution of grape sugar was prepared by dissolving 0.8846 gm. in 250 c.c. of water.

Upon titration, 10 c.c. of "copper-liquor" demanded 12.62 c.c. of the sugar solution to reduce all the oxide to the state of suboxide.

But this *volume* of sugar solution contains 0.0446 gm. of grape sugar.

	Theory.	Practice.
10 c.c. of "copper-liquor" =	0.050	0.044

Expt. 3.—Fehling's solution was prepared by dissolving 11.2638 grms. of cupric sulphate in 100 c.c. of water, 56.255 grms. of Rochelle salts in 156.08 c.c. of solution of caustic soda of 1.14 sp. gr., and the mixed solutions were diluted with water to 325.17 c.c.

(b). The standard solution of grape sugar was prepared by dissolving 0.5953 gm. in 250 c.c. of water.

Upon titration, 10 c.c. of "copper-liquor" demanded 20.85 c.c. of the sugar solution to reduce all the oxide to the state of suboxide.

But this *volume* of sugar solution contains 0.0496 gm. of grape sugar.

	Theory.	Practice.
10 c.c. of "copper-liquor" =	0.050	0.049

Having prepared many of the above solutions, I have found it best to carefully ascertain their strength previous to titration.

The actual Analysis.—I measure 10 c.c. of the "copper-liquor" into a small glass flask of about $\frac{1}{4}$ litre capacity, and dilute this with 40 c.c. of water; I then heat the mixture to incipient ebullition, and from a burette I run in the sugar solution in 1 c.c. at a time. After the first cubic centimetre has been added, the fluid shows a greenish brown tint, owing to the hydrated and suboxide of copper suspended in the fluid. Whenever the precipitated suboxide shows its characteristic red colour, I add the sugar solution cautiously until *one* drop completes the reaction.

Like all other processes in volumetric analysis, the final point of the reaction is the most difficult to observe; indeed, the success of most volumetric processes depends mainly upon the precision in which the end of the reaction becomes evident. In titrating *raw* sugar solutions, it is not advisable to remove the extractive matter previous to reduction; no constant results are got by the procedure. The influence of this organic matter in these highly dilute sugar solutions, if any at all, must be very slight indeed.

Estimation of the Extractive Organic Matter.—All samples of *raw* sugar except beet sugar contain a considerable quantity of this substance. It is best estimated gravimetrically by dissolving about 4 grms. of the raw sugar in a very small quantity of boiling water, and precipitating by addition of solution of tri-plumbic acetate. Whenever this is accomplished, raise the mixture to the boiling-point, pass the supernatant clear sugar solution through a weighed filter, then throw the residue upon the filter, wash most carefully for a long period of time with absolutely boiling water, dry in the water-bath for two hours, and weigh. The increase in weight of the filter-paper expresses the sum of the extractive *residue*, which may be easily raised to per cent. The sum of the extractive organic matter may afterwards be determined by special calculation, including deductions, the details of which need no explanation.

There can be no doubt that the success of this experiment depends chiefly upon the rapidity of the filtration. When the sugar solution, which need not be more than 40 c.c., is passed through the filter-paper at boiling-point, all goes well; but, if it is allowed to cool, filtration becomes tedious, and no amount of boiling water will ever free the residue from lead and syrup. I always precipitate in a very small glass beaker, as I have found by experience that it is much easier to get the residue upon the filter than were a glass flask used. The results in the hands of an experienced manipulator are very satisfactory.

Estimation of the Insoluble Organic Matter and Sand and Clay.—All samples of *raw* sugar contain a small proportion of insoluble matter, which is best estimated gravimetrically by dissolving a weighed quantity of the sugar in a large volume of boiling water, and allowing the insoluble matter to settle. The supernatant sugar solution is afterwards decanted; the residue is then washed three times with boiling water by decantation, thrown upon a filter, again carefully washed, dried for two hours in the water-bath, and treated as follows:—The dried residue is carefully transferred, by means of a feather, to a weighed platinum crucible, and weighed; the increase in weight expresses the sum of the *total insoluble matter*. The filter-paper is then carefully incinerated until the ash is white, and the contents of the crucible are ignited for some time, and again weighed. Upon deducting the filter-ash, the residue may supply the sum of the *sand and clay*, the *insoluble organic matter* being found by difference.

Estimation of the Moisture, Ash, and Total Organic Matter.—Sugar, when ignited, leaves a pure white ash, which may consist of sand, soluble peroxide of iron, and salts of the alkalies and alkaline earths, chiefly those of calcium, potassium, and sodium. I always weigh out

about 2 grms. of the sugar into a platinum vessel, dry it first in the water-bath for two hours, and report the loss as *moisture*. I then char this dried residue at a low red heat, and, as soon as the evolution of empyreumatic matter ceases, I cover the platinum vessel with a muffle, supported over it by means of a clamp, the heating being continued until the residue is white. The increased current of air plying over the heated mass facilitates the combustion of the carbon. This method is liable, however, to increase the amount of sulphates present in the ash, owing to the action of the sulphuric acid derived from the coal-gas; in cases where great accuracy is required, the Bunsen lamp must be replaced by a spirit lamp.

Frequently the carbon refuses to be oxidised. When this happens, it is advisable to place the platinum vessel over the flame of a powerful blowpipe until combustion is complete. The residue is then weighed; after deducting the sand and clay, a calculation will supply the sum of the *soluble salts*. The difference between the two weighings expresses the amount of *total organic matter*.

Iron in Sugar.—The detection of this constituent is a point in the analysis of sugars which is of considerable importance to sugar refiners. I dissolve *the ash* from the previous experiment in a little water, and run the solution thus formed into a moderate-sized test-tube. I then acidulate with a few drops of hydric chloride, and add solution of the potassic sulphocyanide (KCNS), and observe the result carefully; a *blood-red colour* is produced, due to the formation of a soluble iron sulphocyanide (FeCNS_3). This test for iron is the most delicate of all; it will indicate the presence of a ferric salt when all the other tests fail. The red colouration may in such cases be detected more distinctly by resting the test-tube upon a circle of white filter-paper, and looking through it from the top. The sensitiveness of the reaction may be increased by adding hydric chloride, and then ether, and shaking. The ferric sulphocyanide dissolves in the ether, and the colour is concentrated.

This delicate system of detecting iron in sugar answers admirably during the preparation of the quantitative analysis; but at a sugar works, where a great number of samples have to be examined every day, a much rougher test is used, viz., tincture of galls. Some of the sugar we wish to examine is placed in a glass phial, such as is used by sugar refiners to contain "sugar-liquor;" it is dissolved in a small quantity of water, and the tincture then added and the moisture vigorously shaken. If a ferric salt be present, a *black solution* will form of the ferric vanogallate (black writing ink), and the deeper in proportion.

Valuation of Raw Sugar.—In refining *raw sugar*, several points demand special attention. The crystallisable sugar is important as determining the amount of refined capable of being produced, the fruit sugar and soluble salts as retarding crystallisation to a large extent, and the extractive organic matter the amount of animal charcoal required to extract it from the raw sugar, as well as the amount of deterioration which the charcoal itself suffers.

The French method of assaying raw sugars is, upon the whole, very satisfactory. It is based upon two assumptions—(1) That each percentage of fruit sugar prevents the crystallisation of an *equal* amount of crystallisable sugar; (2) that each per cent of soluble salts prevents the crystallisation of five times its own weight of crystallisable sugar.

To value a sugar, then, we must multiply the sum of the soluble salts by five, add the quotient to the sum of the fruit sugar, and deduct the whole from the crystallisable sugar; the remainder is the crystallisable sugar *obtainable* (*vide* analytical table).

I propose shortly to considerably extend these notes upon the analysis of sugar in my future communication, and afterwards bring forward the subject of sugar crystallisation (boiling) in vacuum sugar pans.

Cappielow Sugar Refinery, Carlsdyke,
by Greenock.

SOCIETY OF PUBLIC ANALYSTS.

PRESSURE of space compelled us to abbreviate to the smallest dimensions the discussion which followed the reading of the report which the Council of the Society presented to the general meeting on the 5th inst. As, however, several points of interest were raised, we now think it worth while to subjoin a somewhat fuller report of the proceedings.

Dr. DUPRÉ—There are two points in the Bill which I should like to draw attention to; and if the Council have not already urged the subject upon the Government, I would ask them to do so. First of all, there is the clause where it is stated that any purchaser should be allowed, or should be compelled, to divide the sample into three portions. That seems to be an exceedingly objectionable clause; it, in fact, puts the analyst entirely at the mercy of anybody who likes to tamper with the sample. And perhaps I may just state that, happening to be only last week in a town which I will not mention, the inspector sent a boy to take a sample. The man himself went with him. The sample was taken, divided into two parts, and each one had a seal put on, to make the two samples so that they could not be tampered with. As it happened, the analysis of the Analyst was disputed, and both samples were put into my hands, so that I can speak with perfect certainty that the two samples were not the same. In spite of the seals having been put on, and in spite of both sides swearing that the samples were identically the same, they were extremely different; so that there can be no doubt whatever that one or other sample had been tampered with. Of course, if that division is carried out, such cases would occur very often. It would be very difficult for the Analyst to prove that his analysis was correct, more particularly if the certificate is to be admitted where the poor Analyst is required to retain the entire remainder of the sample. Well, then, I should like it to be urged most strongly on the Government, that the only satisfactory division of the sample is in the presence of all the three parties—the purchaser, the seller, and the Analyst. The next point is, that, at present, any sample that is to be analysed by the Public Analyst is bought by the two inspectors; the inspector puts his mark, and the Analyst does not at all know where it comes from. The Analyst returns his certificate, simply stating, "I have received a sample marked so-and-so, and it is" either "pure" or "adulterated." Such a certificate is very difficult to make use of for the purpose of advertising. Under the present Bill every purchaser may come to the Analyst himself. He brings the sample, and the Analyst is to return a certificate stating, "I have received a sample of so-and-so;" and he is to address it, not only to him, but to everybody it may concern, which, of course, would be all the people who buy such things. Under those provisions it is almost impossible for an Analyst to draw a certificate, or to write in such a manner that the certificate cannot be used for the purpose of advertising; and, of course, there is no guarantee that the sample that he has analysed will be the same afterwards sold. Now, I am strongly of opinion that there is nothing that has thrown so much discredit upon Analysts as this indiscriminate giving of certificates; and a good many Analysts, as it is well known, have always strenuously objected to giving any certificates. It seems to me exceedingly hard, after we have struggled for a long time against giving any such certificates, that we are here required by law to give a certificate to every man who is willing to pay the half-crown or ten shillings for the analysis which is made. I should therefore urge strongly upon the Council to bring it before Government, that either the present plan be retained—that is, that every purchaser is to bring the article to the inspector, and that he simply keeps the sample marked with a figure which the inspector puts on without knowing where it comes from—or that no certificate given by a Public Analyst

should be made use of for the purpose of advertising. Of course that might be the case. I see that several other points have been mentioned, and I hope that the Council will see whether they can manage to bring this before the Government. I am afraid that this is the last public occasion upon which we may have an opportunity of speaking before this Bill passes the House of Commons. I should like to hear some further remarks made, because it will be the most important business we can do this evening to really fairly settle this question. Some of the papers may very fairly wait, but this is a matter which cannot wait.

Mr. WIGNER—I think, perhaps, it would be better, even at the risk of a little informality, to answer questions at once. First, as to the 13th clause. I have personally urged twice upon Mr. Clare Sewell Read the alteration which is proposed in the 13th clause, and I received a half promise that the Government would make it; and, more than that, he promised to accept the amendment if put on the paper by a Member, and one now stands on the paper by Dr. Cameron, which will provide that the inspector will bring away out of the shop two out of the three portions. The Analyst will have the choice of which of the two he keeps. It is but an imperfect substitute, I admit, but it is the best that we have yet been able to get. As to the words in the certificate—"I retain the residue of the sample not consumed in the analysis herewith"—the Government explained distinctly that they did not mean by that the portion of the article which we have not used, but that they mean by it the portion referred to in the 14th section; that is, that when a sample is sent by post to the Analyst he shall send back the reference sample, and that is the portion that is referred to. The phraseology will, we hope, be altered in committee. As to the question of certificates, the Government have in their possession the new form of certificate which we have adopted; and, in addition to that, an amendment is on the paper in Dr. Cameron's name which virtually amounts to the same thing.

Mr. BLYTHE—I wish to urge upon the Council a few things in reference to this particular Bill. I, myself, undoubtedly, am very much obliged for the amendments proposed by the Council, and all the Analysts in the United Kingdom, I am sure, share my feeling of gratitude for the trouble they have taken. But there are two ways of looking at a Bill—the one microscopically, and the other as a whole; and I think that, as far as I have heard or read hitherto, the Council have rather looked at it clause by clause, and not looked upon it as a whole. I was extremely surprised to find that by their silence they have approved the principle upon which this Bill is based, as I have always held, that the sanitary principle is most erroneous. Now if we look at the adulteration laws in existence in Europe at the present time, we find that the law of France is based upon fraud, with certain sanitary provisions. The law of Belgium only deals with the adulteration of food with noxious substances; and in other countries—in Germany, Switzerland, and Italy—the regulations are, I know, entirely sanitary. But why is that? It is because they have no sanitary laws like our own. Now, it so happens, that the sanitary officers of the United Kingdom can deal most effectually with foods at the present time if they are injurious to health; so that, after looking at it from that one single point of view alone, if the legislature wishes to make a Bill for dealing with things with that one single point of view, all that they have to do is to enlarge the 10th and 11th sections of the present Consolidated Public Health Bill, which will be shortly considered in Parliament. Those sections consolidate various Acts relating to food, and give powers to the Medical Officers of Health to inspect, examine, and, if necessary, seize any animal, carcase, meat, poultry, game, flesh, fruit, vegetables, corn, bread, flour, or milk exposed for sale; so that if the legislature wished to make a Bill merely for the protection of the public health, all that they would have to do would be

to enlarge that section, so that the Medical Officer of Health can have those articles analysed, and Public Analysts appointed in each county. That is why I think the principle is entirely erroneous. But if it be a sanitary act, then it should be consolidated with the Consolidated Sanitary Act, and carried out entirely by sanitary commissioners, and not by a mixture of chemists and public officers. Then I would also urge upon the Council the amendment of that clause appointing no less than five inspectors to take samples. If it be a sanitary Bill, then let the sanitary officials carry out its provisions. If it be a Bill based upon fraud, a proper man to collect samples is a police-constable, or, at all events, the police force. I cannot understand this mixture of sanitary officers and policemen. The Act by which we hold our appointments appointed three officers, and that, I believe, is too many. There should be but one person appointed by the legal authority. There is another point to which I think due prominence has not been given, and I would urge upon the Council to try and get an amendment in that respect, and that is, that it should be equally carried out all over the country, and that it should be compulsory. It is a very curious thing that it is about the only Act which does harm if not fully carried out. For example, if you are extremely active in one particular county, and the neighbouring county is not active, the adulterated goods are drafted from one county to the other. I have taken the counties, and made a table of them, which shows that the percentage of adulteration in the counties alone varies from 7 per cent to 48 per cent. Now if we are all working equally upon proper principles, it shows to my mind very clearly that there are some districts more sophisticated than others; that is, that the wholesale adulterator, if he has not a map in his office with the active districts marked with a particular colour, and the active towns marked with a particular colour, has it in his brain; and where the analyst is not there it is he drafts his goods. In twenty-seven counties no appointment appears to have taken place. Therefore, I think I am right in asking the Council to put this very strongly before the Government.

Mr. WANKLYN—I should wish to make a few remarks on the question of the object of this Act. Touching the desire to make this an Act to put a stop to fraud, there are great practical difficulties in the way of any enactment dealing with fraud; but really this Act appears to me to be partly a sanitary Act, and partly an Act for dealing in a much more stringent manner than with the mere question of fraud. We do actually propose to punish people, not when they are not sufficiently vigilant, but we propose to punish dealers for ignorance, for carelessness, and for fraud; and we do not propose to pass any judgment as to which of these dealers have offended. It appears to me that, in this respect, the Act is very wide indeed. The Act would be almost unworkable with our laws if we were to require the proof of fraud against people; but, if we are not required to prove fraud, and if all that we have to do is to show that the articles of food do not come up to the value, and so punish a man either for fraud, or for want of knowledge, or for negligence, I think the Act better for the community than if we were to deal simply with fraud. I regard the Act as a very broad one.

Dr. STEVENSON—With regard, Sir, to the division of samples, I may state that, ever since I have been an Analyst, in two of my districts the process of division of samples has been carried out under legal advice, in a manner which is almost—I may say certainly—identical with that which Mr. Wigner has explained to be proposed as an amendment on the new Bill, and it is this:—That, when the sample is procured by the inspector, he divides it into three portions, one of which he seals up and leaves with the vendor, and the other two portions are brought to me, both sealed, by the inspector. One of these is divided, and the other is not divided, but is retained; so that if, in case the vendor should produce an analysis rebutting my own, there would be the sample which wa

taken by the inspector in his presence, and which the vendor has had an opportunity of putting his seal upon at the time it was procured. In this way there would be three samples, so that any tampering with the sample could at once be detected. I may state that this has been carried on with many hundreds of samples, and that no difficulty has arisen except in one case, where the vendor disputed my analysis of butter, and procured a certificate of another analyst, to the effect that the sample which he had sent him was unadulterated. That same analyst subsequently, on analysing my sample, agreed with me, and said that it was adulterated. That was the only case in which any difficulty arose. I cannot make out that in that case there was any tampering with the sample; but it seems rather that the analyst had changed his opinion. With regard to the approval of the Bill, I think the Council would energetically repudiate any such statement as that they approved the Bill as it went before Parliament. The original Bill, as first printed, met with a most energetic opposition on the part of this Council. The effect has been that the original Bill, which has been passed *pro forma*, is virtually a new Bill altogether.

Mr. JONES—There seems to me one difficulty about the division of the sample into four portions, as proposed by Dr. Stevenson, and it would arise in the case of bulky or extensive samples. Taking beer as an instance, where we require half a gallon of beer for an analysis, you see the amount of bulk that the inspector would have to carry about with him. In order to deliver his samples, he would have to take, according to Dr. Stevenson, about three gallons.

Dr. TRIPE—I do not propose to go into a discussion with regard to any part of the principle of the Bill. I would merely point out that there is a somewhat singular misconception that five persons may obtain the samples, or that five persons might be appointed by the authorities to obtain them. The words of the 12th section are clear:—"Any Medical Officer of Health, Inspector of Nuisances, *or*" (not *and*) "Inspector of Weights and Measures, *or* inspector of a market, *or* any police constable, at the direction and at the cost of the local authority, appointing such officer, inspector, or constable, may procure any sample of food or drugs." Now, in the face of those disjunctives, I cannot think how anybody could take them as the copulatives, and say "*and*" in every case where the Bill has distinctly stated "*or*." I may say that the Council held a long meeting, and that they gave a vast amount of time—I know, for myself, that it has been time that I could very badly spare—in discussing this Bill, and we are satisfied that we have had it materially altered, and have obtained an alteration for the better; but we do not approve of it as it stands, although we think that it is better to get the best you can than to oppose it tooth and nail, and say, "We will have nothing to do with it if you do not alter it as we wish." My opinion is, in these matters, that the law of England has been to a great extent a matter of compromise between party and party, and those who are so extremely ultra, as a rule, get nothing. If you can make a good compromise, I think it is far better than to go farther and fare worse.

Mr. WIGNER—The Council have proposed very strongly that the Government should make the appointment of Analysts compulsory, and the last reply was—"When you can pass a law which can compel a sufficient number of capable analysts to be found in every town, then we will make the Act compulsory, but not until then." They evidently have an opinion that it is utterly impossible to find competent analysts everywhere. As to the division of the samples, I may say that I have pressed it as strongly as possible; therefore, all that can be done as to the sealing of the samples has been done.

Dr. REDWOOD—I would just like to offer one remark in reply to what has been said by Dr. Dupré—merely an explanation. Dr. Dupré seemed to think that the 11th clause, as it stands, would be objectionable, inasmuch as

it sanctions, or authorises, any purchaser of an article to take such article to an Analyst and get it analysed for a small fee, which shall not exceed half-a-guinea; and the objection I take to be founded very much upon this: that the certificate so obtained may be used for the purposes of advertisement. I presume that many Analysts have occasionally to do what I am sometimes called upon to do, namely, to analyse privately, and not officially, articles which may also, under other circumstances, go before the official Analyst through the inspector. That is to say, grocers will sometimes send samples of tea, or other articles, to be analysed. I have always made it a practice to refuse to issue certificates in such cases on any other condition than that the certificate shall refer to the article merely under a certain letter and number; and I never introduce into the certificate the name of the person from whom the article is received; and I do not see anything in the Bill, as it stands, that requires the Analyst to do anything more than to indicate who the party is from whom he has received the article. Without the name, I do not see how the certificate could be used for the purpose of advertisement in the manner indicated.

Dr. DUPRÉ—I think you will see, if you read the certificate, that it is headed—"To Mr. So-and-so, and all whom it may concern." The Analyst is obliged to state that he has received from Mr. So-and-so a sample of such and such an article. I say the law, coupled with the certificate, is very objectionable. Either one by itself might not be objectionable.

Mr. SUTTON—My name has been mentioned in connection with the suggestion with regard to those who are connected with pharmacy—for instance, having anything to do as Public Analysts. Well, I can quite see a great deal of force in that. I can quite see the objection that is taken, on theoretical grounds, to anybody who is concerned in any business—in a pharmaceutical or dispensing business, and so on—having anything to do with a matter of this kind. But, at the same time, I can quite excuse myself personally, as I can excuse other people too, from being involved necessarily in any complication in the matter, just in the same way in which I am concerned. I happen to be the chemist of the Norfolk Chamber of Agriculture, and I happen, also, to be a manufacturer of manures on a very large scale, and I do not know at all what samples come to me. They come to me quite independently of my own knowledge, and I cannot tell my samples from any other person's samples; and I might condemn myself readily, as I might condemn other people, without knowing who was who. If you know that you have a man whom you can depend upon, it does not much matter. We cannot find analysts in every corner of the country, or just everywhere; and we must find men who have got special experience. And I must say, with regard to pharmaceutical chemists, that their botanical education and other studies, which are well calculated to instruct them in many things connected with this investigation, very much fits them for the post of Analyst. But I cannot get rid of the feeling in my mind that I should not like to have the appointments put into the hands of those people exclusively, or even largely. At the same time, if you can depend upon the people having the skill for it, there need not be any objection. Of course, they can be checked in every way. If there is any trickery, it will soon be found out, and it seems to me that, so long as you get hold of the right man, it does not matter what he may be. The rule that would exclude everybody in the business is a mistake, but still it has its claims; and, having said that, I leave it.

A METHOD OF DETERMINING THE FUSING-POINTS OF FATS.

By ARTHUR ANGELL.

Principle.

If a weight be placed upon the top of the cold fat, the fusing-point of which is to be estimated, it will sink as

soon as the fat is so far liquefied as to present less resistance than the weight can overcome.

If this sinking be found constant, and a given weight be universally used, reference tables of relative sinking or fusing-points may be constructed for all fats; and if mixtures of fats be found to behave in accordance with the figures set down in these tables, then the qualitative and percentage composition of a given mixture may be approximately estimated.

The most convenient form of weight is that of a glass bulb containing mercury, the gravity of which is of course not arbitrary: all our figures are, however, based upon one weight, and of course—if our tables are to be of any use—that same weight must be adopted.

The bulb is made by blowing a small globe on the end of a piece of glass tubing of $\frac{1}{4}$ inch outside diameter, and drawing it off with a tapering neck, very near the bulb. By this means a pear-shaped float is obtained. Sufficient mercury should be introduced to cause the bulb to weigh 3.4 grms., which is the weight of the bulb used in our experiments.

The bulb should displace, as near as possible, 1 c.c. of water, when immersed in a burette. Absolute accuracy is not necessary, since it was found that a slight difference—say from 5 to 10 milligrammes—in weight, or a little variation in shape, does not materially affect the results.

Butter and mixtures of it with other fats are the fatty substances with which food analysts will have mostly to deal: our researches have, therefore, been pushed in that particular direction, and only those fats have been tested which are likely to be used as adulterants of butter.

By using such a weight as that described above the sinking-point of all butters comes within the limits of 3 degrees, and any number of observers witnessing an experiment would agree when to read the thermometer. Beef, mutton, pork, and other fats, are also equally constant, provided that they are taken from the same part of the animal.

To take the sinking-point of a butter, place 20 or 30 grms. in a dish or beaker, and melt in the water-bath: when quite fluid pour into a test-tube, of $\frac{3}{4}$ inch interior diameter and about 6 inches long, until filled to within about 2 inches of the top. Keep the tube warm until the whole of the water, casein, and salt has sunk, and left a *perfectly clear fat*; now solidify, by immersing the tube in water of 15° C. temperature. Immerse the tube containing the sample in cold water, contained in a beaker of the capacity of 1 litre: the top of the fat must be about 1½ inches below the surface of the water. A convenient method of fixing the tube in position is to pass it through a hole drilled in a piece of wood, and placed across the top of the beaker: by this means two or more sinking-points may be taken at the same time. Having fixed the tube in an upright position, drop the bulb on to the surface of the fat. The arrangement is now complete, and heat may be applied by means of a Bunsen burner, raised so as to just touch the sand-bath. The water should now be stirred at intervals, and the thermometer read off just as the whole of the globular part of the bulb has sunk beneath the fat.

The following results had been obtained by this method previous to the month of August last year, and many other samples of pure butter have since been tested, with a like result: the numbers are placed without selection, in the order in which they were obtained:—

Sinking-Point with Genuine Butters.

Butter from town-fed cows..	..	..	35.3° C.
„ Hertfordshire ..	..	..	36.1
„ St. Lawrence ..	..	..	34.8
„ Chale..	..	..	36.3
„ Newport ..	..	..	35.3
„ Ventnor ..	..	..	35.3
„ „ No. 2..	..	..	35.5
Farm butter from Niton ..	..	..	34.8
Fresh „ Ventnor ..	..	..	35.1

Farm butter from Chale ..	..	..	35.6° C.
„ „ „ ..	..	..	36.3
Rancid butter..	..	..	35.8
Farm butter from Chale ..	..	..	36.3
„ „ Ventnor ..	..	..	35.5
„ „ „ ..	..	..	34.3
Sussex butter ..	..	..	35.5
Normandy butter ..	..	..	35.7
Butter from Ventnor ..	..	..	36.1
„ „ „ ..	..	..	35.3
Jersey butter ..	..	..	35.3
Butter from Guildford ..	..	..	35.7
„ „ „ ..	..	..	35.3
Salt butter from Ventnor ..	..	..	35.9
„ „ „ ..	..	..	34.8
Average of twenty-four samples ..	..	..	35.5
(Varying from 34.3° to 36.3°.)			

*Adulterated Butters.**

I. Butter from Ventnor, 1s. 2d. per lb.	35.9°
II. „ London, „ „	42.7
III. Kiel butter, 1s. per lb. ..	38.4

No. 1 was found to contain 32.83 parts of genuine butter and 67.17 of foreign fat, the sinking-point of the mixture being normal: the fat used as adulterant had, therefore, a sinking-point very near that of genuine butter, and was probably dripping or some prepared fat.

Sinking-Point of Fatty Acids from Butter.

I. ..	..	..	..	..	..	..	..	41.8°
II. ..	..	..	..	..	..	..	..	42.1
III. ..	..	..	..	..	..	..	..	40.5
IV. ..	..	..	..	..	..	..	..	41.1

Sinking-Point of Fats other than Butter.

Tallow from candle ..	..	..	..	..	53.3° C.
Butterin (patented) ..	..	..	..	..	31.3
Ox fat ..	..	..	..	from 48.3 to 53.0†	
Mutton fat ..	..	..	..	from 50.1 to 51.6‡	
Lard..	..	..	..	from 42.1 to 45.3	
Dripping ..	..	..	..	..	42.7
„ from beef ..	..	..	..	..	43.8
„ „ ..	..	..	..	..	44.5
„ veal ..	..	..	..	..	47.7
„ mixed ..	..	..	..	..	42.6
Cocoa butter ..	..	..	..	..	34.9
Palm oil ..	..	..	..	..	39.2
Stearin ..	..	..	..	..	62.8

Sinking-Point of Mixtures.

			Found.	Calculated.
66.7 per cent butter and 33.3 tallow ..	..	..	43.1°	42.0°
73.0 „ „ 27.0 mutton fat	..	..	42.3	40.2
10.0 „ „ 90.0 „	..	..	48.8	49.6
85.0 „ „ 15.0 ox fat ..	..	..	38.1	38.1
69.8 „ „ 30.2 „ ..	..	..	39.5	39.8

ON A METHOD OF TAKING THE MELTING-POINT OF FATS.

By CHARLES HEISCH.

THERE is nothing either original or novel in the method of taking the melting-points of fats which I have to describe to-day; but as it has yielded in my hands better results than any other which I have tried, and as experience has taught me the precautions necessary to ensure concordant results, I have thought it worth while to bring the method, and more particularly the said precautions, under your notice.

The method is a very slight modification of one described some thirty-five years ago by a gentleman who was at that time a pupil in the Laboratory of University College,

* Proved to be adulterated by subsequent treatment.

† Average, 50.6°.

‡ 50.9°.

in a paper in which he pointed out the fact that some fatty bodies had two melting-points. Glass tubes, of about 0.2 inch bore, are drawn out at the end till almost capillary, the capillary portion being about 3 inches long. The melted fat is drawn into this to the height of about 1 inch, and allowed to cool; in the original plan the end of the tube was sealed, but since that time it has become customary to leave it open. The tube is then placed, together with a thermometer, in a beaker of water, the part of the tube containing the fat being on a level with the bulb of the thermometer, which should be at least 2 inches from the bottom of the beaker. Heat should be now applied very gradually, the temperature being raised at the rate of about 1° F. per minute, and the moment watched at which the fat rises in the tube. The experiment is made by placing one beaker within another, the tube and thermometer being in the inside beaker, there being 2 inches of water at the bottom of the inner beaker and 1 inch at least round it. I always take the melting-point in two different tubes, and when two beakers are employed the difference will never be more than about $\frac{1}{2}$ a degree. When only one beaker is employed accidental circumstances will sometimes cause a warm current of water to rise against the tube, and make a greater discrepancy in the results; but the difference between two experiments is never great, as may be seen from the following results obtained from butter-fats freed entirely from curd and water. I may mention that No. 1 is the fat of absolutely pure butter, to which no salt had been added. The others are believed to be pure butters. The difference in the melting-point of No. 1 and the others is very marked. The experiment with No. 1 was repeated five times, the largest differences being those indicated in the table.

		<i>Melting-Points.</i>			
		Tube No. 1.		Tube No. 2.	
		Degs. C.	Degs. F.	Degs. C.	Degs. F.
No. 1	..	36.3	= 97.5	35.6	= 96
No. 2	..	31.3	88.5	31.1	88
No. 3	..	31.1	88.0	31.7	89
No. 4	..	30.9	87.5	30.6	87
No. 5	..	32.2	90.0	32.2	90
No. 6	..	33.0	91.5	32.8	91
No. 7	..	32.2	90.0	33.3	92
Lard	..	38.8	102.0	39.5	103
Suet	..	44.3	112.0	43.8	111

I should mention that all shaking of the beaker should be avoided. A person walking heavily across the room will make several degrees difference in the apparent fusing-point.

In order to try how far the water in the inner vessel was heated regularly throughout, experiments were made with thermometers at the surface and at different depths in the inner vessel, and when the temperature did not rise at a greater rate than 1° F. per minute the variation among them was (after the water had reached about 75°) not more than 0.25° F..

"SALE OF FOOD AND DRUGS BILL."

THE Committee on this Bill was resumed on the 13th inst., and—though there were still five pages of amendments on the paper—such rapid progress was made that before the House rose the Bill passed through Committee, and was reported. It is needless to say that the majority of the amendments were either withdrawn or negatived, and many of them were so impracticable that their authors could never have seriously contemplated their being accepted by the House.

Clause 22 provides for appeals to Quarter Sessions, and gives power to such Courts to "finally determine the matter of such appeals."

In the previous clause, referring to the examination of samples by the *employés* in Somerset House, Sir H. W. Peek endeavoured very hard to get the word "final" inserted, and in this clause he made an equally strenuous

attempt to get the word "finally" struck out. We are glad, for the credit of the House of Commons, that he was equally unsuccessful in both efforts.

Clause 24, which provides a method of escape for a retailer innocently selling adulterated goods, where he can produce a written warranty of purity from the wholesale dealer, was hotly contested, and it was amusing to see the change of front on the part of members representing "trade" interests. Hitherto their contention has been that adulteration is all a myth; but when asked to display the courage of their opinions by guaranteeing their customers from loss by means of a warranty, they protested vehemently against having to do anything of the kind. The fairness of the provision being, however, obvious to all unprejudiced persons, and the President of the Local Government Board insisting that unless the words were retained the whole Bill would fall to the ground, the clause was agreed to.

Various other amendments were considered, some minor ones were accepted, and ultimately, as we have said, the Bill passed through Committee.

We hope to present our readers with a copy of the Bill, as it now stands, very shortly, and we will reserve any further remarks until we are able to do so.

CORRESPONDENCE.

MELTING-POINTS OF FATS.

To the Editor of the Chemical News.

THE author of "An Easy Method of Taking the Melting-Point of Fats" (CHEMICAL NEWS, vol. xxxi., p. 205, 1875) does not seem to know that his process has long been in use, and is published in at least one manual, "Chemistry; General, Medical and Pharmaceutical" (Van Voorst), at page 313 of the first edition of that work (1867), and in each of the subsequent editions the following sentences occur:—

"Heat a fragment of the substance till it liquefies, and then draw up a small portion into a thin glass tube about the size of a knitting needle. Immerse the tube in cold water contained in a beaker and slowly heat the vessel till the thin opaque cylinder of solid fat melts and becomes transparent; a delicate thermometer placed in the water indicates the point of change to the fifth of a degree."

The author of the paper proposes to record a softening point rather than the true melting-point of the fat. Why?

T. A.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 15, April 19, 1875.

The President (M. Fremy), in his opening address, paid a tribute to the memory of the unfortunate aëronauts, MM. Crocé-Spinelli and Sivel.

Second Note on the Theory of the Processes of Magnetisation.—J. M. Gaugain.—Not adapted for abstraction.

New Source of Magnetism.—M. Donato Tommasi.—If a current of steam at a pressure of 5 to 6 atmospheres is passed through a copper tube of 2 to 3 m.m. in diameter, and coiled spirally around an iron cylinder, the latter is magnetised so effectually that an iron needle, placed at the distance of some centimetres from the steam magnet,

is strongly attracted, and remains magnetic as long as the steam is allowed to pass through the copper tube.

Unequal Solubility of Different Surfaces of the same Crystal.—M. Lecoq de Boisbaudran.—The author has previously (*Comptes Rendus*, October 12, 1874, p. 1868) shown the mutual independence of the surfaces of a crystal in presence of a solvent; the simple forms behaving in some respects like so many polymorphic modifications of one and the same body. From this principle it results that the curves of solubility of different orders of surfaces are not necessarily parallel, whence result possible changes in the sign of the relative solubilities of two surfaces when the physical conditions vary. The following experiment is suited to demonstrate the independence of crystalline surfaces:—An octahedron of alumino-ammoniacal alum, 25 m.m. in diameter, and having small cubical facets, was placed in a basic solution of the same salt, the liquid being kept for a long time in a state of very slight supersaturation. The diameters of the crystals, *i.e.*, the distances between the centres of the cubic facets, had been carefully measured. After some time, the weight had increased by about one-eighth, and the cubic facets had acquired a relatively considerable extent. In spite of this assimilation of matter, the distances between the centres of the cubic surfaces had not varied. The deposition of matter, therefore, had been exclusively effected on the octahedral surfaces; on the cubic surfaces it had been *nil*. Thus the solution was supersaturated as regards the octahedral surfaces, but not as regards those which were cubic. The unequal solubility of different surfaces of the same crystal explains the following fact:—When, after having mutilated a crystal, it is replaced in a mother-liquor which gives up to it scarcely anything, we know that the fracture separates, and that the crystal quickly resumes its original form. This phenomenon is readily understood if we consider that the new surfaces laid bare by the fracture are always more stable (assimilate dissolved matter more readily) than the surfaces of the intact crystal. The fact may be expressed thus:—Every crystal takes the form for which the quantity of matter which undergoes the change of state is a minimum. If, therefore, the liquid is only just saturated as regards the intact surfaces of the crystal, it will be inevitably supersaturated in relation to the surfaces of the fracture which, being alone able to assimilate the dissolved matter, become obliterated. The crystal may thus repair itself without anything being deposited upon its intact surfaces.

Note on the Bronzes of Japan.—E. J. Maumené.—The composition of the specimens in question is as follows:—

	I.	II.	III.	IV.
Copper	86.38	80.91	88.70	92.07
Tin	1.94	7.55	2.58	1.04
Antimony ..	1.61	0.44	0.10	—
Lead	5.68	5.33	3.54	—
Zinc	3.36	3.08	3.71	2.65
Iron	0.67	1.43	1.07	3.64
Manganese ..	—	trace	—	—
Silica	0.10	0.16	0.09	0.04
Sulphur	—	0.31	—	—
Loss	0.26	0.79	0.21	0.56

100.00 100.00 100.00 100.00

The author considers these bronzes as the result of the direct use of copper pyrites and antimonial galena, mixed with blende.

Part Exercised by Alkaline Salts on the Vegetation of the Beet-root and the Potato.—M. Pagnoul.—Salts of potash improve the yield, the mean of which is 273 quintals in two cases where it was used, and only 230 in the cases where soda was applied. Alkaline nitrates and sulphates are more favourable than chlorides and sulphate of ammonia. The ash of the roots in all the experimental lots contained not a trace of soda. The absorption of chlorides does not benefit the plant, these salts exerting no useful function in vegetable life.

Equivalence of Alkalies in Beet-root.—MM. P. Champion and H. Pellet.—The alkaline carbonates in the ash of beet-root are not only saturable by a constant quantity of sulphuric acid, but the totality of soda and potash contained in the ash in the state of phosphate, sulphate, chloride, and carbonate corresponds to the same weight of acid. It is the same with the ash of the leaves if the mode of cultivation is the same, whilst the proportions of soda and potash in the manures are varied. The authors hope to show in a future memoir that the law of the substitution of bases in accordance with their equivalents is not a fact peculiar to beet-root, but extends to wheat, barley, maize, scarlet beans, peas, mustard, flax, &c.

Note on the Dextrogyrous Acid of Wine.—E. J. Maumené.—The author believes that the acid isolated by Béchamp in a great number of wines is the trigenic.

Part of Microzymas in the Acid, Alcoholic, and Acetic Fermentation of Eggs.—M. A. Béchamp.—A reply to the paper by M. Gayon, *Comptes Rendus*, lxxx., p. 674.

Moniteur Scientifique, du Dr. Quesneville,
March, 1875.

Retrospective Studies on Liebig.—A trilogy comprising an account of Liebig's scientific career, by H. Kolbe; a review of his agricultural researches, by Prof. Stehmann; and an account of his investigations in animal chemistry, by M. Neubauer. We hope to return, by opportunity, to this paper. At present we merely extract the startling fact that during the first ten years of his professorship at Giessen Liebig received merely the contemptible salary of £70 per annum, out of which he had to pay his assistant, and to provide apparatus and reagents—the laboratory furnished him by the University consisting merely of four bare walls.

Properties of Salicylic Acid.—H. Kolbe.—In this paper, and in the subsequent one by Neubauer, attention is called to the remarkable antiseptic and antizymotic power of salicylic acid. This property it is proposed to utilise in medicine, in the preservation of food, and in the manufacture of fermented liquids—cases where the carbolic and cresylic acids are not applicable on account of their offensive taste and poisonous properties.

On Aniline Inks.—C. H. Viedt.—For a red ink the author recommends a solution of 1 part of "diamond fushin" (we should say of Brooke, Simpson, and Spiller's rosein) in 150 to 200 parts of boiling water. For a blue he dissolves 1 part of bleu de Paris in 200 to 250 of water. For a violet, 1 part of a Hofmann's violet (blue shade) in 300 of water. A beautiful green ink is made by dissolving 1 part of iodine green in 100 to 110 parts of boiling water. The yellow aniline inks are not recommended. These inks are not fit for copying, but they have the advantages of drying quickly, and of never clogging.

Means of Distinguishing the Coal-Tar Colours.—The coal-tar reds most generally met with in commerce are magenta, saffranin, and red corallin. The aqueous solution of magenta is coloured by acids a yellow; that of saffranin a violet-blue; and that of corallin gives a yellow precipitate. Three principal violets are met with, the phenylic, the iodine, and the methylic. Dissolve a part in alcohol, and add ammonia. If the solution becomes red, the colour is a phenyl-violet; if it is completely discharged, we have an iodine- or a methylic-violet. To decide between these two, dissolve a little of the colour in water, and add ammonia. The iodine-violet is decolourised, and gives a clear solution, whilst methylic violets become colourless, but troubled. The two coal-tar blues known at present in the market are aniline blue and Nicholson blue. The latter may be known by its forming a colourless solution in water, which turns blue on the addition of an acid. The most common greens are aldehyd green and iodine green, with or without picric acid. If the colour dissolves in water it is iodine green.

if not, it is dissolved in alcohol, and a solution of potassium cyanide added. Aldehyd green is decolourised under the influence of this reagent, whilst the picrate of iodine green is turned brown. The most usual yellows are picric acid, with its salts, and naphthalin yellow, all being soluble in water. Mix the aqueous solution with a solution of potassium cyanide, and heat. If the liquid becomes a reddish brown, picric acid or one of its salts is present. If the colour is merely somewhat deepened, we have naphthalin yellow. To distinguish between free picric acid and its salts, a portion of the sample is moistened with benzol, and heated. If the body dissolves it is picric acid, if not, a picrate. Among the oranges the chief are—Yellow corallin, the salts of chrysaniline and chryso-toluydin, and Victoria orange, as well as a mixture of naphthalin yellow and of magenta, known as "aniline orange." Dissolve a little of the sample in alcohol, and add some zinc and dilute sulphuric acid. If the liquid is decolourised it is corallin; if it preserves its colour it is a compound of chrysanilin. If ammonia does not produce a red colouration, dissolve a part of the sample in water, and add an acid. If there is no change, it is a compound of chryso-toluydin; if a precipitate appears it is Victoria orange, or a mixture of both. To decide, take a small portion of the aqueous solution, and add solution of cyanide of potassium. If the liquor turns brown on heating we have Victoria orange; if the shade is but slightly modified, it is a mixture of naphthalin yellow and magenta. The chief browns are—Aniline brown, maroon, garnet, and two phenyl browns; that prepared with carbolic acid, and that with phenylen-diamin. Examine if the substance is soluble in water; if not, add hydrochloric acid. If the solution turns yellow it is maroon; if there is no change add a little ammonia. If a precipitate appears, it is either aniline brown or phenyl brown prepared with phenylen-diamin. If the ammonia produces no effect the colour is garnet (isopurpurate of potash). Phenyl brown is distinguished from aniline brown by adding cyanide of potassium, which precipitates the latter, while it has no effect on the former.

Industrial Preparation of Iodide of Potassium with the Waters used for Lixiviating Kelp or Crude Soda.—The process consists in transforming into iodates the alkaline iodides contained in the lixivium; in precipitating the iodic acid with a soluble salt of baryta; heating the precipitate with a solution of sulphate of potash, by means of which we obtain a solution of iodate of potash; evaporating to dryness, melting the residue, and crystallising the solution of iodide of potassium thus obtained. The transformation of the alkaline iodides of the mother-liquors into iodates may be effected by one of the methods indicated below; but it is necessary to precipitate previously, in totality, or in great part, the sulphuric acid present by means of a solution of chloride of barium. After having removed this precipitate, the mother-liquor is evaporated to dryness, and the residue melted to destroy all organic matter. The melt is then dissolved in water, and the solution filtered. If the treatment is to be conducted on the first, second, or third method, the solution is made alkaline by the addition of a caustic or carbonated alkali; adding so much that there may be, for each equivalent of iodide, 5 equivalents of caustic, or 10 of carbonated alkali. The four methods of subsequent treatment are—(1) Pass through the liquid until all the iodide is converted into iodate, but no longer. (2) Add to the liquid a solution of an alkaline permanganate till a faint but permanent pink colouration results. Separate from the liquid the precipitate of manganese, which may be revived in known manners. (3) Pass through the dilute liquid an electric current. (4) Add an equivalent of an alkaline chromate for each equivalent of iodide; evaporate to dryness, and heat cautiously, without raising the residue to redness. After the iodic acid has been separated from the lye, the bromide which remains in solution may be converted into bromate by the first or the fourth method.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

An improved treatment of cod-liver oil. William Robert Lake, of the firm of Haseltine, Lake, and Co., patent agents, Southampton Buildings, London. (A communication from Jean G. Hava, New Orleans, Louisiana, U.S.A.) July 14, 1874.—No. 2458. The said invention consists in a solution of tribasic phosphate of lime in cod-liver oil by passing a current of carbonic acid gas in a mixture of gelatinous tribasic phosphate of lime and cod-liver oil under different degrees of pressure.

Improvements in the method of and apparatus for treating residua of distillation, fermentation, and similar operations, in order to obtain and utilise ammonia, carbonic acid, ammoniacal salts, alkaline carbonates, saltpetre, and other products. Michael Henry, patent agent, Fleet Street, London. (A communication from Louis Charles Emeric Faucheux, Boulevard Saint Martin, Paris.) July 16, 1874.—No. 2483. The object of the invention is the treatment of residuary products of distillation and other like processes in order to utilise them, such as the carbonic acid from fermentation of saccharine matters, and ammonia from distillers' wash, for producing ammoniacal salts, alkaline carbonates and bicarbonates, and saltpetre. Various processes are described in which chemical reactions are used. Ammonia may be extracted by means of caustic potassa and soda, obtained by a preliminary operation, and the alkalies are afterwards employed. Lime is used, and afterwards precipitated by the carbonic acid of fermentation, and this mode of obtaining ammonia is by means of gases arising from the combustion of distillers' wash by injecting steam, or by showers of water with or without sulphuric acid. Residua may be treated with caustic alkalies. Ammonia is used in producing bicarbonates. Carbonic acid freed during fermentation is collected in closed vessels with tubes connected with a worm for condensing the alkaline vapours, and with a gas-holder with suction arrangements. The carbonic acid is used for producing bicarbonate of soda by means of ammonia, or with crystals of carbonate of soda, or for producing carbonates, by its action on sulphurets of potassium or sodium, or for producing carbonation, or for obtaining bicarbonate of potassa, or for other purposes. Apparatus is described for obtaining ammonia, in which a truncated cone is placed in the chimney through which pass the gases to be decomposed, and with which a refrigerator is combined. Apparatus for producing bicarbonate of soda is described, in which cylinders and tanks are combined with arrangements for bringing the ammoniacal and carbonic gases to the solutions, and with refrigerators, such as a chamber and worm, or a contrivance for using the pressure of the carbonic acid. Steam, superheated or not, is used to heat the apparatus in which the bicarbonate is decomposed. A mode is described of extracting ammoniacal salts from residua in a state of hydrochlorate of ammonia without acids. Carbonate of potassa is produced from bicarbonate of potassa and sulphuret of potassium, the bicarbonate being obtained by the action of the carbonic acid from the fermentation. Also, bicarbonate of soda is employed. The disengaged sulphuretted hydrogen is utilised, and sulphites and sulphur are produced. Saltpetre is obtained by treating nitrate of soda, carbonic acid, and ammonia, proceeding from residua, or by a process based on the double decomposition of the nitrate of soda and chloride of potassium under ebullition; and the sea-salt or bay-salt obtained as a residuary product is treated by ammonia and carbonic acid. A mode is described of treating and refining raw potassa for producing saltpetre, or for other purposes.

Improvements in the separation of ammonia from illuminating and other gases. John Henry Johnson, Lincoln's Inn Fields, Middlesex. (A communication from Benjamin Silliman, New Haven, Connecticut, U.S.A.) July 18, 1874.—No. 2520. This invention relates to an improved process for the purification of illuminating and of other gases, and consists in the employment of certain acid salts for the purpose of removing ammonia and other ammoniacal impurities contained in such illuminating gas or other gases.

Improvements in treating sugar, syrups, and juices for decolourising and purifying same. William Whitthred, analytical chemist, Liverpool. July 20, 1874.—No. 2532. I add to the solutions of sugar, or to the syrups or juices, milk of lime, and heat the mixture. I then add dicalcic phosphate dissolved in an aqueous solution of monocalcic phosphate, or dicalcic phosphate dissolved in water supersaturated with carbon dioxide, or mixed with an absorbed body, such as any kind of charcoal, to defecate the impure syrup or juices; and I remove the insoluble matters by any of the well known means. This part of my invention I prefer to use where weak solutions exist; for stronger solutions, I prefer to filter through charcoal, and cleanse same by any of the well known processes, and I revivify this charcoal by adding to it either of the phosphatic solutions above described.

Improvements in the preparation of superphosphate of lime, and in the manufacture of nitrogenised manures. Rudolf Giebertmann, Lower Thames Street, London. July 21, 1874.—No. 2547. The object of this invention is to produce from phosphorites, coprolites, and, in general, from substances which contain, besides phosphate of lime, silicates, fluorides, iron, and alumina compounds, a dry superphosphate of lime, in which the phosphoric acid which has been made soluble in water remains in that state by adding sulphuric acid quickly in form of rain or shower, and keeping the batch agitated or stirred after this time with such rapidity as to prevent, as much as possible, the mass from heating. If desired to prepare nitrogenised superphosphates, there is added together with the sulphuric acid a concentrated solution of horn, hair, hoof, leather, wool, or other animal refuse. By this, manure is obtained containing the nitrogen in a condition readily assimilable by vegetation.

THE CHEMICAL NEWS.

VOL. XXXI. No. 809.

A SIMPLE METHOD FOR TESTING FOR POTASH.

By J. STEINER,

Chemist (formerly Assistant at the Agricultural High School in Vienna).

THE weighed substance, containing not more than 0.2 grm. of K_2O , is to be treated, after dissolving it in a few c.c. of hot water, with a clear concentrated solution of caustic baryta, and heated for about ten minutes. The liquor now contains the alkaline salts and BaH_2O_2 . By conducting in CO_2 , and heating afterwards to expel the free CO_2 , the solution retains the alkaline salts only. A drop of pure Na_2CO_3 added to the clear liquor ascertains if the preceding operations are complete. The clear liquor may be filtered and washed with hot water by means of an aspirator.

If properly managed, the liquor does not exceed 250 c.c. After concentrating it in a platinum dish on the water-bath, a few c.c. of HCl are added, the evaporation continued to dryness, the residue dissolved in a little hot water, and, after adding 1 grm. of $PtCl_4$ in about 10 c.c. of water, again evaporated till dry, but at about $90^\circ C$. only. By mixing the cold residue with alcohol of 80 per cent, the insoluble $PtCl_4.K_2Cl_2$ may be collected on a filter after about half an hour, washed with alcohol, and dried. The precipitate is reduced by heating it with a little pure oxalic acid to platinum, which is then weighed.

Goulding's Manure Works, Dublin,
May 10, 1875.

REPORT ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from page 222).

WAGNER's statement† must be noted that, in the year 1867 both these methods were not carried out in Deville's laboratory, perhaps because the development of sulphurous acid complicated their execution; in fact, they have both been left in the background in industrial practice. As an attempt in that direction, we must notice the procedure of Archereau,‡ who employed sulphuric acid in its cheapest combination, gypsum. He maintained that, by heating ground gypsum with sand, he could obtain silicate of lime, whilst sulphurous acid was set free, which he (as also Susini) chiefly condensed by a pressure of three atmospheres, and removed the rest by passage through milk of lime. A manufactory on this principle, established at Paris, had but a short career.¶ The very high temperature required is evidently a hindrance. Probably the oldest source of oxygen, saltpetre, had not been used for the preparation of the gas, for two reasons. On the one hand, the product is largely mixed with nitrogen, and on the other, the temperature required for its decomposition augments the cost of preparation. Webster§ overcame

the latter difficulty by adding to the nitre oxide of zinc. 20 lbs. of soda-saltpetre and 4 lbs. of crude oxide of zinc yielded in his hands 94.676 cubic feet of a mixture of 59 per cent of oxygen and 41 per cent of nitrogen, the residue being chiefly oxide of zinc and caustic soda. In this mixture, which is useful for many purposes, the oxygen cost 2.32 francs per cubic metre if the solid residue be neglected; but, if the latter be utilised, the expense of the oxygen falls to 0.78 franc.*

In all these methods, one of the leading ideas of modern industry, the regeneration of residues, has been neglected. The following proposals are, in this respect, happier, and have, therefore, been partially more successful. To combine the oxygen of the atmosphere chemically with some substance which shall readily give off the combined gas, and be again able to take up and give off fresh quantities of oxygen, as is done by the mercury in mercuric oxide; this is the problem which has been solved in the last few years. As early as 1829, Dingler, Junior,† observed that both oxide of copper and the peroxides of nickel and cobalt, with an excess of chloride of lime, gave off oxygen, converting the latter substance into chloride of calcium. In 1845, Mitscherlich‡ made known the fact that various other metallic oxides, peroxide of manganese, hydrated peroxide of iron, &c., if added to a solution of chloride of lime, occasioned a plentiful liberation of oxygen. In 1865, these observations were renewed by T. H. Fleitmann,|| with especial reference to recently prepared sesquioxide, small quantities of which sufficed to decompose completely a concentrated solution of chloride of lime into chloride of calcium and oxygen gas. He recommended, in practice, a solution of chloride of lime concentrated as much as possible, and clarified by filtration or deposition to prevent frothing, and then mixed with 0.1 to 0.5 per cent of its contents of sesquioxide of cobalt, and heated from 70° to 80° . On employing chloride of lime at 35 per cent, he obtained oxygen in a regular stream, to 25 or 30 times the volume of the liquid. Other observers, especially F. Varrentrapp,§ confirmed these results, and recommended the industrial adoption of the process. The sesquioxide of cobalt does not require to be manufactured in advance. Any salt of cobalt in solution serves the same purpose, and the sesquioxide settles to the bottom and can be used again in fresh operations.

(To be continued.)

ON AMMONIO-SILVER CARBONATE.

By SERGIUS KERN, St. Petersburg.

By adding, to a concentrated solution of silver carbonate (Ag_2CO_3) in ammonia, ethyl-alcohol (C_2H_5O), a peculiar grey precipitate is received, containing the elements of ammonia. In order to study the reactions and the nature of this compound, some experiments were made, the results of which are as follows:—

The silver carbonate was prepared by mixing concentrated aqueous solutions of hydric sodium carbonate ($HNaCO_3$) and silver nitrate. The yellowish precipitate of silver carbonate obtained was well washed and dried over sulphuric acid; the dried salt was dissolved in ammonia, 0.930 sp. gr., and from this solution the ammonio-silver carbonate compound was thrown down by means of absolute alcohol; the resulting grey precipitate was washed and dried. The ammonio-silver carbonate thus obtained gave the following reactions:—

(1). The compound in the state of perfect dryness takes a more intense dark colour; some drops of ammonia im-

* "Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends."

† Wagner, *Jahresberichte*, 1867, 216.

‡ Archereau, *Dingler's Polyt. Journ.*, clxxviii., 57.

§ Wagner, *Jahresberichte*, 1867, 215.

§ Pepper, *CHEMICAL NEWS*, 1862, 218.

* Dupré, *Comptes Rendus*, lv., 736.

† *Dingler's Polyt. Journ.*, xxvi., 231.

‡ Mitscherlich, *Pogg. Ann.*, lviii., 471.

|| *Ann. Chem. Pharm.*, cxxxiv., 64.

§ *Mittheilungen f. d. Gewerbe Vereins des Herzogthums Braunschweig*, 1865-66, 72.

mediately turn the substance black, and readily dissolve it.

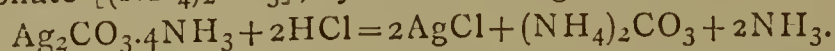
(2). Gently heated to 80° , it commences to yield ammonia gas, which disappears at 100° . This was proved by placing on the top of the crucible red litmus paper, which turned blue. Some drops of hydrochloric acid gave, with the evolved gas, white fumes, proving the gas to be ammonia.

(3). Two grms. of the substance, heated on a sand-bath in a porcelain crucible at the following temperatures, undergoes the following changes:—

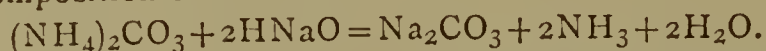
- 100° The substance blackens.
 160° to 170° .. Conversion into a uniform black mass.
 240° The substance partly whitens from the decomposition into metallic silver.
 305° Conversion into metallic silver.

(4). A solution of ammonio-silver carbonate in ammonia, dried over calcium chloride, gives needle-shaped crystals of irregular form. The crystals dissolved in ammonia turn black, and the undissolved part falls down in the form of a black powder.

(5). The ammonio-silver carbonate, in the form of a black powder, resulting from the experiment No. 4, was dissolved in hydrochloric acid. There was a strong reaction, evolution of gas, and production of silver chloride (AgCl) and of a small quantity of neutral ammonia carbonate $[(\text{NH}_4)_2\text{CO}_3]$, by the following reaction:—



The presence of the ammoniacal salt was proved by testing the salt by means of a concentrated solution of sodium hydroxide (HNaO); ammonia gas was received from the decomposition of the salt:—



(6). The ammonio-silver carbonate may be considered as a direct compound of silver carbonate and ammonia, having the formula $\text{Ag}_2\text{CO}_3 \cdot 4\text{NH}_3$. At ordinary temperatures, this substance is a stable compound, which may be preserved for a long time without alteration; but, as it is seen from the experiments, it is readily decomposed by the action of heat and acids, with the evolution of ammonia gas.

LECTURES ON THE MORPHOLOGY OF CRYSTALS

AT THE

CHEMICAL SOCIETY.

By NEVIL STORY MASKELYNE, M.A., F.R.S., &c.

(Concluded from page 202.)

LECTURE XIV.

THERE remain to be considered, among the phenomena of crystallography, certain modes of grouping, or of association of crystals in obedience to particular laws, some of which present points of extraordinary interest to the student of physics. The first to be considered among these was that known as the case of twinned or macled crystals. Thus, two crystals parallel in position may be supposed to be the one fixed, and the other turned round an axis, generally the normal of a face through 180° . Sometimes the two crystals appear thus grown together, either in superficial juxtaposition, or else inter-penetrating one another, and that, sometimes, in such a way that parts or laminæ of the one crystal are interpolated between, and alternated with, laminæ of the other crystal, sometimes with even microscopic minuteness. A result of this twinned character is the frequent occurrence of re-entering angles on the crystal.

Among the more singular varieties which arise out of this twin law are cases in which hemi-symmetrical forms have undergone this introversion. Thus, in the cubic system, hemi-symmetrical forms of the type $\pi\{hkl\}$

may be twinned, yet so as not to produce a holo-systematic form, since evidence of the twinning is recognisable in the physical character of the faces. Another very interesting kind of twinning is one of which we may take the mineral boracite as an illustration, in which we find two correlative hemi-symmetrical forms of the type $\kappa\{hkl\}$

united into a crystal which would carry all the faces parallel to those of a octahedron, but in such a way that, for instance, the tetrahedral faces of the one form, $\kappa\{111\}$, present different physical properties from those

which characterise the correlative form $\kappa\{\bar{1}11\}$, among which the property of becoming, the one positively electric, and the other negatively electric, by increase of temperature, and again having these electricities reversed as the temperature is lowered, is conspicuous. Further, the faces of one of the tetrahedra are brilliant, and those of the other dull. In such a case, it is clear that the physical properties going one way along a given direction in a crystal are not the same as the properties going the opposite way along it, and this polar character is also met with in crystals that are hemimorphous; that is to say, in which all the faces of a form on one of the sides of a plane (necessarily a unique plane) of symmetry are obliterated. Then, again, there are cases of a species of composition of hemi-symmetrical forms in which two correlative diplohedra, but hemi-systematic forms, as, for instance, two correlative rhombohedra are twinned in such a manner as to build up a holo-symmetrical form. Of this, quartz is a conspicuous example, the rhombohedra, $\{hkk\}$ and $\{eff\}$, uniting to form the twelve-faced diplohedron, wherein, however, the physical dissimilarity of the faces of the two forms betray the composite character of the crystal, in spite of their geometrical equivalence.

Finally, we have to consider the singular case of rotatory polarisation of the light by crystals, and this would seem, so far as the few cases that connect this property with crystalline form serve to guide us, to be connected with a hemi-systematic character in the forms presented by the crystal. Victor von Lang has pointed out that, in all the cases so far known, such as the sodium-chlorate, quartz, lead hyposulphate, and sodium-periodate, the hemi-symmetrical forms belong to what in our phraseology would be a hemi-systematic type, of which only one face is extant for each extant normal. Such a generalisation would, if confirmed, preclude the possibility of rotatory polarisation in the orthorhombic, the clinorhombic, and the anorthic systems.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 20, 1875.

Professor ABEL, F.R.S., President, in the Chair.

AFTER the names of the visitors had been announced, and the minutes of the preceding meeting read and confirmed, Messrs W. A. Lyttle and Francis Jones were formally admitted Fellows of the Society. The names read for the first time were those of Messrs. L. Bernstein, G. W. Wigner, J. M. Cameron, G. Archbold, and R. W. E. McIvor. For the third time—Messrs. Pattinson Melmore, Gustav Bischof, Charles Gerard Cresswell, Thomas Wardle, Dugald Clerk, William Grant, George Johnstone, and Henry Child, who were balloted for and duly elected.

The first communication, "*Notes on Milk in Health and Disease*," was read by the author, Mr. A. H. SMEE. From a series of carefully-conducted experiments, he

found that, although milk taken from herds of cows exhibits great uniformity in composition, yet the milk from individual cows is liable to considerable variation; moreover, it is possible for good average milk to be watered to a limited extent without detection. He observed, also, from a comparison of the milk from cows fed on ordinary meadow grass and on grass from a sewage farm, that in the latter case the milk went putrid after thirty-six hours, and the butter became rancid rapidly compared with that made from the milk of cows fed on ordinary meadow grass. These effects were more apparent in spring than in the latter part of the summer. On three or four occasions, also, he noticed that, when the milk of cows fed on sewage grass was placed on a dialyser, the casein passed through the membrane, from which it would appear that the casein existed in these milks in a modified form. He then proceeded to notice the outbreaks of typhoid fever which had occurred at various places owing to sewage-water having been used to cleanse the dairy utensils, or to reduce the quality of rich milk to the lowest standard allowed by law, showing how important it was that there should be a supply of pure water to every dairy. Moreover, milk which had been exposed to sewer-gas from an untrapped drain, although on analysis it appeared to be unaltered in composition, yet when distilled at a low temperature (160° F.) it yielded a distillate which had a very offensive smell. It also caused intense headache, which was followed by diarrhoea. He also examined the milk of cows suffering from foot and mouth disease and from milk fever, and thought that the methods employed by Public Analysts were not sufficiently delicate to detect the slight physiological changes which may take place in so complex a fluid as milk.

The PRESIDENT observed that there were so many interesting points connected with the subject that it could not fail to elicit a valuable discussion.

Dr. GILBERT said the subject was one of very great importance. Mr. Smee had shown, not only that there was great variation in the milk of different cows, but of the same cow at different times, and yet the evidence he had brought against the use of sewage grass was derived from observations on one or two cows. Now that the demand for milk from the country to supply London was so great, it created quite a milk famine in some parts. If we employ the water system for sewage it must be passed on the land where it produces succulent food fit for cows. If the cows were fed entirely on sewage grass the milk was but little inferior to that from unsewaged grass, and with a proper addition of oil-cake the milk was excellent. The analyses in the Report of the Royal Sewage Commission made by Messrs. Way and Evans on the milk of cows fed for a long period on sewage grass and oil-cake showed that the amounts of casein, butter, sugar, &c., were very nearly the same as that of cows fed in the ordinary way, but, as might be expected, there was a slight deficiency in the butter and sugar. No doubt great mischief would arise when sewage-water was used to adulterate milk, or for cleaning the dairy vessels.

Mr. W. THORP asked whether the cows had been fed for some time previously on sewage grass, or were immediately transferred to it. This was a point of some importance, for the alteration of the diet from the drier to the more succulent one would cause the cows to get out of condition, which would necessarily affect the milk.

Dr. THUDICHUM said the lowness of the ash in the milk of those cows which had been fed on grains was a physiological question of some interest. The grains had been exhausted of their salts, and the food not containing the proper quantity, the cows would get out of condition. This might, perhaps, be obviated by adding the necessary salts to the food to make up for those removed from the grains.

Dr. THORNE gave some instances in which children fed on milk from cows suffering from foot and mouth disease had suffered from salivation and sore mouths. When the use of the milk was discontinued, the symptoms dis-

appeared. In these cases, the children were at a farm, the milk came direct from the cow, and was used copiously and without dilution. After being allowed to cool, or to stand for some time, the milk did not appear to produce any injurious effect.

Mr. SMEE said there were a few points to which he must allude. Dr. Gilbert had stated that the cows were fed with sewage grass, but, as he parenthetically observed, with something dry added, such as oil-cake. It was this something dry which made all the difference, for when nothing but sewage grass was used the cows pined away and died. He must insist that cows cannot be fed on sewage grass alone. Another point was that the casein had become altered, and good cheese could not be made from the milk. He had invariably found that the butter from his own herds, which was ordinarily very good, became so rank and bad when sewage grass was used for the cows' food, that he would not let it come into the house.

Dr. GILBERT wished to say a few words in reply to Mr. Smee's remarks. All sewage grass was very succulent; every farmer knew that ordinary grass in some years was very succulent, and then it was found advisable to give some dry food along with it. Why, then, not give it with the succulent sewage grass? When the fields were irrigated with sewage, the amount of milk per acre was increased four or five times.

Mr. A. H. SMEE, in reply, said that he looked upon sewage grass as the only way of getting rid of the sewage, but he found that the dairymen round about him never used it if they could help it, for it made the butter rank. The grass, he learned, was sent up to London to be sold as green meat.

The PRESIDENT, in thanking the author, said he did not think that the opinions of Dr. Gilbert and Mr. Smee differed so greatly as might at first sight appear.

Mr. W. H. DEERING then read a paper "*On some points in the Examination of Waters by the Ammonia Method.*" He found that the intensity of colour produced by the Nessler solution went on increasing, and had not come to a stop in ten minutes, the increase being, perhaps, more readily perceived with the paler than with the darker tints. In order to obviate this difficulty, the author, after adding the Nessler to the distillate, and allowing it to stand ten minutes, prepares a caramel solution of the same tint, and compares this with the trial solution of ammonium chloride, which is also allowed to stand ten minutes. He also finds it is necessary to make a correction for the trace of ammonia remaining even in the purest attainable distilled water, and for the alkaline permanganate solution, which should be boiled for a long time, as commercial stick potash gives much ammonia when distilled with water. An important fact, also, is that peaty waters give much ammonia by distillation with sodium carbonate, and much, also, on the subsequent distillation with permanganate solution, which, unless caution be used, might be regarded as evidence of sewage contamination.

The PRESIDENT drew especial attention to the fact that peaty matters existing in potable matters interferes considerably with the indications given by this test. This was a point of very great importance.

Mr. W. THORP said he had not experienced the difficulties in the use of the Nessler test mentioned by Mr. Deering. He found that, when he began, he could only obtain results accurate within 5 or 6 per cent, but that after a few months he could trust them to within 2 or 2½ per cent, and he had never found anyone who could judge nearer than that: it was therefore not of much practical use to endeavour to eliminate these very small sources of error. If the nitrogen in peat waters were estimated by the combustion process, it would be found that the carbon was large in proportion to the nitrogen, as compared with sewage contamination.

Mr. HARTLEY said that, in employing the Nessler test in places where other work was being done, it was very necessary to keep the cylinders closed during the distil-

lation, although there might be no odour of ammonia in the room, otherwise erroneous results would be obtained.

Dr. RUSSELL could confirm Mr. Deering's observations on peaty water, for he had collected some on Dartmoor which contained some ammonia as salts and a considerable amount of albumenoid ammonia.

Mr. DEERING, in reply, said he quite agreed with Mr. Thorp, that the Nessler test was comparatively inaccurate, from there being only about fifteen colour factors which the eye could distinguish. He appeared to have somewhat misunderstood the object of the caramel solution, which was not to get a caramel standard, but to serve as a comparatively unalterable point of comparison for the solution to be examined and the Nessler.

The PRESIDENT, in thanking the author, said he agreed with Mr. Thorp that the combustion method in some cases possessed considerable advantages over the Nessler test.

The last paper was "*On some Nova Scotian Triassic Trap Minerals*," by Professor H. HOWE. He gives an account of centrallassite, stilbite, sphærostilbite, magnetite, and magnetic hæmatite. The first-mentioned mineral, although closely corresponding, in constituents and apparent quantitative composition, with okenite and gyrolite, is merely related to them, closely indeed, but the merging of one into either of the others as a species is inadmissible.

After thanking the author in the name of the Society, the PRESIDENT adjourned the meeting until Thursday, June 3, for which a large number of papers are announced:—(1) "On the Agricultural Chemistry of the Tea Plantations of India," by Dr. C. Brown; (2) "On the Effects of Pressure and Cold upon the Gaseous Products of the Distillation of Carbonaceous Shales," by Mr. J. J. Coleman; (3) "On the Structure and Composition of Pseudomorphic Crystals having the form of Orthoclase," by Mr. J. A. Phillips; (4) "On Nitrosyl Bromide, and on Sulphur Bromide," by Mr. M. M. P. Muir; (5) "On the Action of Chlorine on Pyrogallol," by Dr. J. Stenhouse and Mr. C. E. Groves; (6) "On some New Derivatives of Alizarin," by Mr. W. H. Perkin; (7) "On some Metallic Derivatives of Coumarin," by Mr. Williamson; and several other communications.

PHYSICAL SOCIETY.

May 22, 1875.

Professor GLADSTONE, F.R.S., President, in the Chair.

THE names of the following candidates for election were read for the first time:—The Lord Lindsay, F.R.S.; Sir W. Thomson, F.R.S.; and Prof. Sylvester, M.A., F.R.S.

Mr. SPOTTISWOODE, F.R.S., exhibited and described a "*Revolving Polariscope*." A luminous beam passes from a small circular hole in a diaphragm through a polariscope, the analyser of which is a double image prism, the size of the hole being so arranged that the two luminous discs shall be clear of each other. If the prism be made to revolve rapidly, one of the discs revolves round the other, and is merged into a ring of light, which is interrupted at opposite sides by a dark shaded band, the position of which depends upon the position of the original plane of polarisation. The discs may be coloured by inserting a selenite plate, and the rapid revolution of the analyser then gives alternating segments of complementary colours; or, if a quartz plate be used, the rotating disc passes successively, twice in a revolution, through all the colours of the spectrum, and when the revolution is rapid merges into a prismatic ring. The effect of the interposition of a $\frac{1}{4}$ -undulation plate, which converts plane into circularly polarised light, was then shown, and Mr. Spottiswoode also interposed a concave plate of quartz, and exhibited the effect of rotation on the characteristic rings of quartz.

Prof. ADAMS, F.R.S., exhibited a polariscope, adapted for showing the optic axes of a crystal in which they are

much inclined to each other, as is the case in topaz. The part of the instrument by which this is effected consists of a frame in which the crystal is supported between two hemispherical lenses, the common centre of which is at the centre of the crystal. The frame is capable of motion round an axis at right angles to that of the instrument. By this means each of the axes can be brought under the cross wires, and the space through which the frame is moved affords a means of determining the angle between the axes of the crystal. The crystal may be immersed in a liquid, the cases in which its optic axes are too far apart to be seen in air.

Dr. MILLS made a verbal communication on "*Fusion-Point and Thermometry*." His apparatus for fusion-points consisted essentially of a beaker, in which stood an inverted funnel, the shortened stem of which carried a test-tube, supported by a contraction at its base. The test-tube contains naphtha of high boiling-point, and the thermometer and capillary tube containing the substance occupy its centre; the funnel has four equidistant semi-circular cuts at the end of its stem, and six on its lips: the beaker is nearly filled with strong oil of vitriol, and has a wooden cover. On the application of heat below the beaker warm oil of vitriol ascends in the funnel, and, cold oil of vitriol descending, enters at the lips. Thus an automatic stirring is kept up, and the mercury in the thermometer rises so regularly as to appear perfectly continuous in course, even under considerable magnifying power. The manner of preparing and filling the capillary tubes was described. Attention was then drawn to the "zero error" of thermometry. In thermometers which have not been much used, the zero error must always be determined immediately after experiment. It is also generally necessary to correct for the projection of the thermometer beyond its bath. This correction had been experimentally determined by the author, and required from 1500 to 2000 observations of temperature for each of four instruments used. It was ascertained that the well-known expression, $C = 0.0001545(T - t)N$, given by Regnault and Kopp is not supported by actual trial. If we write the expression thus:— $C = x(T - t)N$, experiment shows that x depends on the length N exposed, and $x = a + \beta N$. For lengths of about 25°, x is about 0.00013, and increases about 0.00001 for every additional 25°. The exact values of a and β require, however, to be ascertained for each instrument.

Mr. BAUERMAN, F.G.S., described and illustrated a very simple method for ascertaining the electric conductivity of various forms of carbon. The method which was originally devised by Dr. Von Kobell, consists in holding a fragment of the substance to be tested with a strip of zinc bent in a U-form, and immersing it in a solution of copper sulphate. In the case of a bad conductor, a deposit of copper takes place solely on the surface of the zinc; but when a good conductor is employed, a zinc-carbon couple is formed, and a deposit takes place on the surface of the carbon. Numerous specimens were exhibited, which showed that the conducting power is greatest in coal which has been subjected to a great degree of heat, and the lowest temperature at which this change takes place appears, in the case of anthracite, to be between the melting-points of zinc and silver. Such experiments appear to be specially important, as giving a clue to the temperature at which anthracitic metamorphism has been effected by the intrusion of igneous rock.

Prof. WOODWARD exhibited an apparatus for building up model cones and craters. It consists of a wooden trough about 18 inches long with sloping sides; at the bottom of the trough a bladed screw carries forward the ashes, sawdust, or other material used, to an opening through which air from a powerful bellows is forced upwards. A board, 3 or 4 feet square, with a hole in the centre, is placed over the air-jet, and on this the crater is formed. Several of the peculiarities of natural cones may thus be illustrated, and their structures shown by using sawdust of various colours.

SOCIETY OF PUBLIC ANALYSTS.

THE RECENT CASE OF ALLEGED ADULTERATION OF BEER AT STOKE.

By A. DUPRÉ, Ph.D., &c.

THIS case has been noticed by several daily and weekly papers, and made the occasion of more or less disparaging remarks against analysts. All these papers seem, however, to have been entirely ignorant of the real facts of the case, and I am therefore induced to give such of the facts as have come before me. I am the more inclined to do so as I see that the House of Commons has rejected Dr. Cameron's amendment on clause 13, requiring the samples to be marked and sealed by the analyst. The case will show, conclusively, the difficulties and dangers which will have to be incurred when samples are allowed to be divided by persons not familiar with the art of securing them against being tampered with.

On March 19th I received a sample of beer from the Secretary of the Licensed Victualler's Protection, &c., &c., Society, in North Staffordshire, with the request to analyse the same. I was told, at the same time, that the beer had been reported against as adulterated with salt. I therefore estimated the chlorine no less than three times, twice by precipitation and weighing, once by neutralising, evaporating, charring, extracting with water, and estimating the chlorine, volumetrically, in the very carefully neutralised solution. The figure given is the mean of these three fairly concordant results. On March 31st I received a second sample of beer, from the magistrates' clerk at Stoke, for the purpose of analysing the same. No other information was given. I had, however, the strongest reason to believe that this sample was supposed to be from the same cask as the preceding one. I learnt afterwards that evidence to that effect had been given before the magistrates. In this case, also, the chlorine was estimated three times, and the mean taken. Having a larger quantity of beer at my disposal than I had in the first case, I examined this sample for some of the other substances stated to be sometimes used for the purpose of adulteration. Without wishing to give any decided opinion as to the substance actually used, I may state that an extract obtained from this beer, which would have contained any picrotoxin present, had a most markedly poisonous effect on fish; the extract obtained in the same way from pure beer is without effect. The following are the results of my analyses:—

	First Sample.	Second Sample.
Alcohol, per cent by volume ..	7.75	7.42
Dextrine	5.04	4.26
Sugar and other extractives ..	0.41	1.27
Ash	0.34	0.40
Chloride of sodium	40.90	136.00
Acetic acid	0.48	0.32

These two analyses were performed by myself, in exactly the same manner, within a few days of each other, and I need scarcely remark that the differences between the two, entirely irrespective of the enormous difference in the chloride of sodium, are very far beyond the errors of analysis.

Before analysts are sneered at, it would be well to make sure that they had really the same samples to deal with. In this case, fortunately, the two samples came into one hand, and the differences are such that there can be no doubt whatever that the samples submitted to me were not what they had been represented to be, viz., two samples of the same beer taken from the same cask at the same time.

I trust that it is not too late even now for Parliament to reconsider clause 13, with a view of inserting some provision which will render such substitution of one sample for another, if not absolutely impossible, at least extremely difficult, and if nevertheless done, to render the perpetrator liable to heavy punishment.

Westminster Hospital, May 22, 1875.

"THE SALE OF FOOD AND DRUGS BILL."

THIS Bill having now been read a third time in the House of Commons, we think it well to reprint its leading clauses, and have italicised the alterations which have been made since its introduction.

A reference to the CHEMICAL NEWS of February 26th, in which the original Bill was printed, will show the tenour and the value of the alterations and modifications. As, however, Clause 5 is not only the principal acting clause of the Bill, but has undergone more changes—and those of more importance—than any other clause, we submit a copy of it as it appeared in the Bill in February, and also reprint it as it now stands.

Having already printed the Bill *in extenso* we deem it unnecessary to reproduce the whole of the clauses, and we therefore omit many of a formal character, possessing perhaps points of interest for lawyers, but not bearing on the functions of the Analyst.

Clause 1 simply repeals the Adulteration Acts of 1860 and 1872, the 3rd section of the "Sale of Poisons (Ireland) Act," and the 24th section of the "Pharmacy Act."

2. The term "food" shall include every article *used for food or drink by man*, other than drugs or water:

The term "drug" shall include medicine for internal or external use:

The term "county" shall include every county, riding, and division, as well as every county of a city or town not being a borough.

The term "justices" shall include any police and stipendiary magistrate invested with the powers of a justice of the peace in England, and any divisional justices in Ireland.

3. No person shall mix, colour, stain, or powder, or order or permit any other person to mix, colour, stain, or powder, any article of food with any ingredient or material *so as to render the article injurious to health*, with intent that the same may be sold in that state, and no person shall knowingly sell any such article so mixed, coloured, stained, or powdered, under a penalty in each case *not exceeding* fifty pounds for the first offence; every offence, after a conviction for a first offence, shall be a misdemeanour, for which the person, on conviction, shall be imprisoned for a period not exceeding six months with hard labour.

4. No person shall, except for the purpose of compounding as hereinafter described, mix, colour, stain, or powder, or order or permit any other person to mix, colour, stain, or powder, any drug with any ingredient or material *so as to affect injuriously the quality or potency of such drug*, with intent that the same may be sold in that state, and no person shall knowingly sell any such drug so mixed, coloured, stained, or powdered, under the same penalty *in each case respectively as in the preceding section* for a first and subsequent offence.

Clause 5, as originally drawn:—

No person shall knowingly sell any article of food or any drug which is not of the nature, substance, and quality of the article demanded by the purchaser, under a penalty of *twenty* pounds, except as herein excepted and provided; that is to say, except—

Where any matter is mixed therewith for the purpose of rendering it portable, or of preserving it;

Where a harmless ingredient is mixed with it for the purpose of rendering it

Clause 5, as it now appears:—

No person shall sell to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, and quality of the article demanded by such purchaser, under a penalty not exceeding twenty pounds, except as herein excepted and provided; that is to say, except—

Where any harmless matter or ingredient is mixed therewith for the purpose of rendering it portable or palatable, or of preserving it,

palatable or of improving its appearance;

Where according to the usage of trade it is sold in a mixed state;

Where it is the subject of a patent in force, and is supplied in the state required by the specification of the patent;

Where British, colonial, or foreign spirits are reduced from their ordinary strength by persons licensed and paying duties under the excise;

Where a drug is compounded either in conformity with a prescription of a registered medical practitioner or otherwise, according to the usage of trade;

Where the article is unavoidably mixed with some extraneous matter.

6. No person shall sell any *compound article of food which is not composed of ingredients in accordance with the demand of the purchaser, under a penalty not exceeding twenty pounds.*

No person shall sell any compounded drugs except the same shall be compounded *in accordance with the demand of the purchaser, or with the prescription in writing of a registered medical practitioner, or with the regulations prescribed by the British Pharmacopœia issued by the General Medical Council, or in Great Britain with a basis to be laid down by the Council of Pharmaceutical Society of Great Britain, or the Privy Council, or in accordance with the provisions of the Pharmacy Act, 1868, or in Ireland in accordance with the Act of the Session of the thirty-third and thirty-fourth of Victoria, chapter twenty-six; under a penalty not exceeding twenty pounds.*

7. Provided that no person shall be guilty of any such offence as *aforesaid* in respect of the sale of an article of food or a drug mixed with any matter or ingredient not injurious to health, and not intended fraudulently to increase its bulk, weight, or measure, if at the time of delivering such article he shall supply to the person receiving the same a notice, by a label *distinctly and legibly* written or printed on or with the article, to the effect that the article is mixed.

8. No person shall, with the intent that the same may be sold in its altered state without notice, abstract from an article of food any part of it so as to affect injuriously its quality, substance, or nature, and no person shall sell any article so altered without making disclosure of the alteration, under a penalty in each case not exceeding twenty pounds.

At the end of the 9th clause, which provides for the appointment of Analysts, the Government have added the following sub-section:—"Provided that no person shall hereafter be appointed an Analyst for any place under this Section who shall be engaged, directly or indirectly, in any trade or business connected with the sale of food or drugs in such place.

10. The town council of any borough may agree that the Analyst appointed by any *neighbouring* borough, or for the county in which the borough is situated, shall act for their borough during such time as the said council shall think proper, and shall make due provision for the payment of his remuneration, and if such Analyst shall consent, he shall during such time be the Analyst for such borough for the purposes of this Act.

11. Any purchaser of an article of food or of a drug in any place being a district county city, or borough where

or of improving its appearance, unless such matter is used to conceal the inferior quality of the article;

Where the article named is a proprietary medicine or is the subject of a patent in force, and is supplied in the state required by the specification of the patent;

Where a drug is compounded as hereinafter described;

Where the article is unavoidably mixed with some extraneous matter in the process of collection or preparation.

Provided that no article shall be deemed to be within any of the exceptions above set forth, if the matter or ingredient mixed therewith shall have been added with intent fraudulently to increase the bulk, weight, or measure of the article.

there is any Analyst appointed under this or any Act hereby repealed shall be entitled, on payment to such Analyst of a sum not exceeding ten shillings and sixpence, or if there be no such Analyst then acting for such place, to the Analyst of another place, of such sum as may be agreed upon between such person and the Analyst, to have such article analysed by such Analyst, and to receive from him a certificate of the result of his analysis.

13. The person purchasing any article with the intention of submitting the same to analysis shall, after the purchase shall have been completed, *forthwith* notify to the seller or his agent selling the article his intention to have the same analysed by the Public Analyst, and shall offer to divide the article into three parts to be then and there separated, and each part to be marked and sealed or fastened up in such manner as its nature will permit, and shall, if required to do so, proceed accordingly, and shall deliver one of the parts to the seller or his agent.

He shall afterwards retain one of the said parts for future comparison, and submit the third part, if he deems it right to have the article analysed, to the Analyst.

14. If the seller or his agent do not accept the offer of the purchaser to divide the article purchased in his presence, the Analyst receiving the article for analysis shall divide the same into two parts, and shall seal or fasten up one of those parts and shall cause it to be delivered, either upon receipt of the sample or when he supplies his certificate to the purchaser, who shall retain the same for production in case proceedings shall afterwards be taken in the matter.

16. If any such officer, inspector, or constable, as above described, shall apply to purchase any article of food or any drug exposed to sale, or on sale by retail on any premises or in any shop or stores, and shall tender the price for the quantity which he shall require for the purpose of analysis, not being more than shall be reasonably requisite, and the person exposing the same for sale shall refuse to sell the same to such officer, inspector, or constable, such person shall be liable to a penalty of ten pounds.

17. The certificate of the analysis shall be in the form set forth, or to the like effect.

FORM OF CERTIFICATE.

To*

I, the undersigned, Public Analyst for the
do hereby certify that I received on the day of
18 , from†

a sample of for analysis (which then weighed‡), and have analysed the same, and declare the result of my analysis to be as follows:—

I am of opinion that the same is a sample of genuine

Or,

I am of opinion that the said sample contained the parts as under, or the percentages of foreign ingredients as under:—

Observations.§

As witness my hand this day of
A. B.,
at

* Here insert the name of the person submitting the article for analysis.

† Here insert the name of the person delivering the sample.

‡ When the article cannot be conveniently weighed, this passage may be erased, or the blank may be left unfilled.

§ Here the Analyst may insert at his discretion his opinion as to whether the mixture (if any) was for the purpose of rendering the article portable or palatable, or of preserving it, or of improving the appearance, or was unavoidable, and may state whether in excess of what is ordinary, or otherwise, and whether the ingredients or materials mixed are or are not injurious to health. In the case of a certificate regarding milk, butter, or any article liable to decomposition, the Analyst shall specially report whether any change had taken place in the constitution of the article that would interfere with the analysis.

18. Every Analyst appointed under any Act hereby repealed or this Act shall report quarterly to the authority appointing him the number of articles analysed by him under this Act during the foregoing quarter, and shall specify the result of each analysis and the sum paid to him in respect thereof, and such report shall be read at the next meeting of the authority appointing such Analyst, and every such authority shall annually transmit to the Local Government Board, at such time and in such form as the Board shall direct, a certified copy of the number of articles analysed.

21. The justices before whom any complaint may be made under this Act may, upon the request of either party, in their discretion cause any article of food or drug to be sent to the Commissioners of Inland Revenue, who shall thereupon direct the chemical officers of their Department at Somerset House to make the analysis, and give a certificate to such justices of the result of the analysis; and the expense of such analysis shall be paid by the complainant or the defendant, as the justices may by order direct.

24. If the defendant, in any prosecution under this Act, prove to the satisfaction of the justices or court that he sold the article in the same state as when he himself purchased it, and that he purchased it as the same article in nature, substance, and quality as that demanded of him, and with a warranty in writing to that effect, he shall be discharged from the prosecution, but shall be liable to pay the costs incurred by the prosecutor, unless he shall have given due notice to him that he will admit at the hearing the matters charged against him in the information.

25. Every penalty imposed and recovered under this Act shall be paid in the case of a prosecution by any officer, inspector, or constable of the authority who shall have appointed an Analyst or agreed to the acting of an Analyst within their district, to such officer, inspector, or constable, and shall be by him paid to the authority for whom he acts, and be applied towards the expenses of executing this Act, any Statute to the contrary notwithstanding; but in the case of any other prosecution the same shall be paid and applied in England according to the law regulating the application of penalties for offences punishable in a summary manner, and in Ireland in the manner directed by the Fines Act, Ireland, 1851, and the Acts amending the same.

26. Any person who shall forge, or shall utter, knowing it to be forged for the purposes of this Act, any certificate or any writing purporting to contain a warranty, shall be guilty of a misdemeanour, and be punishable on conviction by imprisonment for a term of not exceeding two years with hard labour;

Every person who shall wilfully apply to an article of food or a drug, in any proceedings under this Act, a certificate or warranty given in relation to any other article or drug, shall be guilty of an offence under this Act, and be liable to a penalty of twenty pounds;

Every person who shall give a false warranty in writing to any purchaser in respect of an article of food or a drug sold by him, as principal or agent, shall be guilty of an offence under this Act, and be liable to a penalty of twenty pounds;

And every person who shall wilfully give a label with any article sold by him which shall falsely describe the article sold, shall be guilty of an offence under this Act, and be liable to a penalty of twenty pounds.

34. This Act shall commence on the first day of October one thousand eight hundred and seventy-five.

35. This Act may be cited as "The Sale of Food and Drugs Act, 1875."

A MEETING of the Society will be held on Wednesday next, the 2nd of June, at Cannon Street Hotel, at 4 o'clock P.M., when "The Sale of Food and Drugs Bill," which has now passed the third reading in the House of Commons, will be again considered. And the following

papers will be read:—"On the Volumetric Estimation of Chlorides, in the Presence of Alkaline Phosphates," by W. C. Young (London); "Improvements in Butter Analysis," by Arthur Angell, F.R.M.S.; "The Decomposition of Milk," by E. L. Cleaver.

NOTICES OF BOOKS.

The Advantages of the Separate System of Drainage.
By E. MONSON, Assoc. Inst. C.E. London: E. and F. N. Spon.

THE object of this pamphlet is to show that sewage, in the strictest sense of the term, should be kept separate from surface-water, springs, &c. It need scarcely be said that the more concentrated sewage can be kept, the more economical becomes its treatment by any process whatever. At the same time it can scarcely be denied that the separate system involves a greater risk of nuisance. At present the drains are, from time to time, flushed by storm-water. As an instance that doctors are not the only parties who differ among themselves, we may mention that a certain eminent engineer, so far from recommending the separate system, suggests that the sewage of London should be diluted to four times its present bulk.

Our author is an enthusiastic admirer of the water-closet system, which in practice has proved to be an ingenious contrivance for introducing sewage-gases into our houses, and which leaves a variety of putrescible and noxious matters to ferment in the dust-bin. He seems to entertain an amusingly exaggerated opinion of the effects produced by his pamphlet—"The Sewage Difficulty Exploded." We certainly have failed to trace any change in public opinion to its appearance. Whether or no sewage has a commercial value, it has an agricultural value, and if we only go on pouring it into the sea we must ultimately run short of fertilising matter. The supply of phosphates and of potash is not unlimited, and in proportion as the nearer sources are exhausted, and as other nations compete with us more and more, prices must rise.

Mr. Monson seems inclined to treat the sewage with lime, and either use the effluent for irrigation or run it into the rivers. This process must, in any case, expel the ammonia, and fail to throw down the alkaline salts. As to the sludge produced--e.g., from the sewage of London--we would venture to say it would prove a difficulty scarcely dreamt of in his philosophy.

Fragmentary Papers on Science and Other Subjects. By the late SIR H. HOLLAND, Bart. London: Longmans, Green, and Co.

WE have here a collection of essays on a great variety of subjects, few of which have any direct connection with chemistry or physics. Of these the most noteworthy are those entitled "Matter and Force in Physical Phenomena;" "On Matter, Force, and Motion in Space;" "Divisibility of Matter;" and "The Electric Element." These essays display a very peculiar character. Did we know nothing of their authorship, we should, from internal evidence, feel compelled to pronounce them the work of one thoroughly versed in the results of modern science and feeling a warm interest in its progress, yet, in his own nature, rather a metaphysician than a physicist. So long as he describes the conclusions of others he is scientific, but the moment he attempts to add anything of his own he diverges insensibly into ontology. He seeks for definitions of force, matter, space, life, electricity. Not content with the research into phenomena he strives to penetrate into noumena, and puts questions which have hitherto proved barren, because

their solution does not lie within the limits of our capacities. He asks, as did the thinkers of earliest antiquity, "What are these unseen forces—call them *δυνάμεις*, *ἐνέργεια*, *vis viva*, potential energy, plastic force, Kräfte, or whatever the diversities or the importance of language may suggest—which thus give movement and change to the material world? What is the matter itself thus acted upon? Is it something brought into existence by a creative will of higher date, or is it eternal in itself, and that with which the Creator worked in evolving and giving laws to the visible universe?" He points out that philosophers have, from time immemorial, asked these questions. He refers with the accuracy of the deeply-read scholar to their doubts, their guesses, and their suggestions. But towards the actual solution of the problems stated he advances no nearer than did his forerunners in this line of thought. We may read his essay on the "Divisibility of Matter." We may recognise in it a fair and full exposition of the present state of human knowledge—and of human ignorance—on the subject. But there is nothing to increase the sum-total of the former, or diminish the sum-total of the latter. He describes eloquently the researches of the past. He does not point the way to the researches of the future. It would, at least, be difficult to find in these essays any suggestion capable of being worked out by the recognised methods of science.

Into the essays dealing with organic science—which seem of higher value—we can, of course, not enter.

Wildungen: Its Baths and Mineral Springs. By Dr. A. STOECKER. Translated by O. HARRER, M.D. London: Trübner, and Co.

AN account of the mineral waters of Wildungen, in the territory of Waldeck, which, it appears, are much recommended in affections of the urinary organs. Incidentally the author mentions the curious fact that in Bristol, Leeds, and Norwich, calculus in the bladder is about ten times more plentiful than at other places,—a fact not easy to explain. The author ascribes the paucity of English visitors at Wildungen to the want of acquaintance of English physicians with the virtues of the waters. But, from whatever cause, mineral springs are not nearly so popular in England as on the Continent, nor as they appear to have been in this country in the last century.

CORRESPONDENCE.

ACCIDENTAL USE OF SULPHIDE OF ANTIMONY.

To the Editor of the Chemical News.

SIR,—In the portion of Dr. Hofmann's "Report on the Development of the Chemical Arts during the last Ten Years" published in the CHEMICAL NEWS, vol. xxxi., p. 221, I observe a statement that accidents have occurred by the accidental use of sulphide of antimony instead of peroxide of manganese in the preparation of oxygen. I can add two instances; one happened to a druggist's assistant in Glasgow, the other to myself. In the latter case, though the materials were purchased at the shop of a thoroughly competent druggist in London, Canada, the mistake occurred of supplying sulphide of antimony instead of peroxide of manganese. I remarked to a friend who was with me while making arrangements for preparing the oxygen, that the manganese looked uncommonly like sulphide of antimony, but, nevertheless, proceeded with our operations. Chlorate of potash and the sulphide of antimony (as I afterwards found it to be by analysis) being mixed in a glass retort, I began to heat gently with a Bunsen lamp, holding the lamp in my hand, and had raised the temperature very slightly, when a

violent explosion took place. On examination, I found that the bulk of the retort had been almost pulverised; and my face and the hand which held the lamp were studded with drops of blood from the punctures of small fragments of glass. I had my coat off at the time, and the sleeve of my shirt was set on fire by the explosion. I believe the circumstances of the other case I have referred to were very similar. Had the retort in either case been an iron one, the results would probably have been more serious. It may be worth recording these accidents as a warning to others.—I am, &c.,

ALEX. T. MACHATTIE.

88, Hope Street, Glasgow,
May 22, 1875.

FUSING-POINT OF FATS.

To the Editor of the Chemical News.

SIR,—In the CHEMICAL NEWS, vol. xxxi., p. 226, is a report of my short paper on a method for determining the fusing-point of fats. Notwithstanding that in some parts of the text is used the possessive pronoun plural, by some mistake the name of my friend and colleague, Otto Hehner, has been omitted. The paper read before the Society of Public Analysts is in the main a reprint of a chapter published in our little book on "Butter Analysis," and it would be an obvious injustice on my part silently to allow my name to figure alone, above anything approaching an abstract from that our joint work. I therefore beg that you will insert these few lines in your next number.—I am, &c.,

ARTHUR ANGELL.

Hants County Laboratory, Southampton,
May 24, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 16, April 26, 1875.

Detection of Ordinary Alcohol Mixed with Wood-Spirit.—M. Berthelot.—The two problems to be solved are—To detect the presence of common alcohol in wood-spirit, and that of wood-spirit in common alcohol. The latter seems solved by the elegant method which MM. Riche and Bardsy have this day presented to the Academy (see below), but M. Berthelot thinks it useful to give here the practical solution of the former. The process consists in mixing the suspected liquid with double its volume of concentrated sulphuric acid. In these conditions methylic alcohol yields gaseous methylic ether, entirely absorbable by water or concentrated sulphuric acid, whilst ordinary alcohol produces ethylen, a gas almost insoluble in water and concentrated sulphuric acid, but which may be recognised and determined by causing it to be absorbed in bromine. On operating with the precautions customary in gaseous analysis, the presence of common alcohol may be detected in wood-spirit, even when the proportion does not exceed 1 or 2 per cent. Aceton and the normal impurities of wood-spirit may yield, under these circumstances, carbonic acid and carbonic oxide, but not ethylen.

Cycle Corresponding to the Performance of Thermic Machines with Open Cylinders, and Demonstration of this Cycle, and of the Weight of the Motive Substance Forming the Working Body.—M. A. Ledieu.—Not adapted for abstraction.

Results of Experiments Made by the Commission on the Vine Disease in the Department of l'Herault.—M. Marès.

Use of Alkaline Sulpho-Carbonates against the Phylloxera.—M. Dumas.—The author considers himself justified in maintaining that the alkaline sulpho-carbonates are a poison for the phylloxera, and that they have no injurious action upon the vines.

Detection and Determination of Methylic Alcohol in Presence of Vinous Alcohol.—MM. A. Riche and C. Bardy.—The wood-spirit used in the adulteration of ordinary alcohol marks 98° on the alcohometer, and its smell and taste are so slight as to escape notice when it is mixed in slight proportions with an alcoholic liquid. If a mixture of alcohol, containing 10 to 15 per cent of this wood-spirit, is distilled, a small quantity of liquid may be separated by means of fractional distillation, which goes over at 78°. The authors at first sought to detect methylic alcohol in this product by transforming it into oxalate of methyl, but without success. They then attempted the solution of the problem by means of the coloured products, differing in shade and stability, which ethyl-aniline and methyl-aniline yield by limited oxidation, and they consider themselves perfectly successful. Introduce into a small flask 10 c.c. of the alcohol, with 15 grms. of iodine, and 2 grms. of red phosphorus, and distil immediately, collecting the product in 30 to 40 c.c. of water. The alcoholic iodide precipitated at the bottom of the liquid is separated by means of a funnel, which is stoppered with the finger, and is collected in a flask containing 6 c.c. of aniline. The mixture grows hot; the reaction is assisted by holding the flask for some minutes in warm water, and moderated by being placed in cold water if a brisk ebullition sets in. After the lapse of an hour, very hot water is poured into the flask to dissolve the crystals formed, and the liquid is brought to a boil until the vessel contains nothing but a clear liquid. To this is added an alkaline solution, which sets free the alkaloids in the form of an oil, which is raised up into the neck of the flask by the addition of a sufficient quantity of water. The oxidation of the alkaloid may be effected by means of perchloride of tin, or, better, by Hofmann's mixture, consisting of 100 grms. of quartz sand, 2 grms. chloride of sodium, and 3 grms. nitrate of copper. Of this 10 grms. are taken, upon which 1 c.c. of the oily liquid is allowed to flow, and carefully incorporated by means of a glass rod. The mixture is placed in a test-tube of 2 centimetres in diameter, which is heated to 90° in the water-bath for eight to ten hours. The matter in the tube is then exhausted by three successive treatments with luke-warm alcohol, which is thrown upon a filter, and made up to the volume of 100 c.c. Pure alcohol gives a liquid of a reddish-wood shade. Alcohol containing 1 per cent of methylic spirit gives a solution which appears distinctly violet when compared with the former. At 2.5 per cent of wood-spirit the result is a very decided violet, which is deepened considerably as the proportions rise to 5 and 10. The liquids may be examined colorimetrically, in tubes of the same calibre, being compared with the results with those yielded by mixtures of wood-spirit and alcohol in known proportions. Or swatches of bleached woollen tissues, of equal weights, may be dyed in the liquids. If the alcohol is free from methylic spirit, the wool remains white, whilst samples containing methylic spirit yield violet shades. A single tinctorial assay serves to show whether coloured sugars owe their shade to the natural matter formed during the boiling of the juice or if they have been artificially coloured with coal-tar compounds. We take 8 to 10 grms. of the sugar, and agitate it for about ten minutes with a few centimetres of alcohol mixed with a little ammonia. The solution is decanted, evaporated almost to dryness, the residue taken up in a little water, and a small piece of white merino is suspended in the boiling liquid for some minutes. If the colour is natural, the stuff is not dyed, but if the sugar has been coloured with any coal-tar preparation, it takes a very decided yellow or brown tint.

Vine Districts Attacked by the Phylloxera in 1874.
Duclaux.

Precipitation of Silver by Protoxide of Uranium.—M. Isambert.—When metallic oxides act upon solutions of silver salts, the action commonly consists in the precipitation of silver oxide, but there may be produced in some cases a deposit of metallic silver. Ebelmen has shown that protoxide of uranium produces in solutions of nitrate of silver a deposit of metal exactly as does copper, 1 equivalent of uranium replacing 1 equivalent of silver, without escape of gas. On repeating Ebelmen's experiment, the author finds the final result completely exact. Protoxide of uranium being thrown into a very neutral solution of nitrate of silver, and well stirred, a bulky precipitate is formed, whilst the protoxide dissolves, and the liquid becomes green. On continuing to stir, this colour disappears, and is succeeded by a yellow shade, characteristic of the sesqui salts of uranium. At the same time, the precipitate decreases in bulk and changes its appearance, passing from its original state of oxide to that of metallic silver. Hydrated protoxide of iron, in like manner, produces a precipitate of metallic silver, with formation of sesquioxide of iron. This property of protoxides of passing to a higher state of oxidation, and of throwing down metallic silver, is shared by their salts.

Action of Platinum and Palladium upon the Hydrocarbides of the Benzinic Series.—J. J. Coquillion.—In a first series of experiments the author has shown that the vapours of toluen, in presence of an incandescent platinum wire and of atmospheric oxygen, yield, as the result of oxidation, small quantities of hydride of benzoyl and of benzoic acid. He has experimented under the same conditions with other carbides of the same series. With benzin and toluen the quantity of hydride of benzoyl obtained is very slight, benzoic acid predominating. With xylen and cumen appreciable quantities of hydride of benzoyl were obtained, which quickly changed into benzoic acid.

Observations on the Spontaneous Alteration of Eggs.—M. U. Gayon.—A reply to a recent paper by M. Béchamp.

—
Bulletin de la Societe Chimique de Paris,
No. 5, March 5, 1875.

Limited Oxidation of the Carbides of Hydrogen.—M. Berthelot.—Not adapted for abstraction.

Researches on the Relation between the Different Colouring Matters of Madder, and on the Part which they play in Dyeing.—M. A. Rosenstiehl.—(Continuation.) Already noticed in the CHEMICAL NEWS.

Researches on Albumen.—P. Schützenberger.—(Continuation.) According to the author's results, albumen is split up by hydrate of baryta into ammonia, carbonate of baryta, amidic acids of the series $C_nH_{2n+1}NO_2$ from amido-œnanthylic acid to the amido-butyric, into tyrosin, and into amidic acids of a more highly oxygenated character, bordering on the aspartic and glutamic acids. The study of these acids will be undertaken in future communications. In incomplete decompositions intermediate crystalline bodies are obtained, containing less hydrogen than leucin and its homologues.

Certain Purple Colouring Matters Derived from Cyanogen.—M. Gaston Bong.—Reserved for insertion in full.

Action of Certain Monatomic Sodic Alcohols upon Camphor.—M. R. D. Silva.—The author having heated for fifteen hours, at 145° to 150° in sealed tubes, a mixture of mono-bromated camphor and sodic ethylic alcohol in known proportions, obtained, on distilling the products, alcohol, which had been present in excess, a solid crystalline body of a peculiar odour, and which passed over between 220° and 240°, whilst a residue containing bromide of sodium remained in the retort. Mono-bromated camphor is thus attacked by sodic alcohol, with separation either of the elements of a molecule of hydrobromic acid,

without substitution, or of an atom of bromine, with substitution of a residue of equal combining value.

Observations on Urines which Reduce Fehling's Test-Liquid, but do not Deflect the Polarimeter.—M. David.—The author in examining a pathological urine obtained results which seemed to indicate 10 to 12 grms. of glucose per litre of urine. Nevertheless, not the slightest deviation was obtained with Laurent's saccharimeter. The death of the patient occurred before the investigation was complete.

Action of Heat on Ordinary Aldehyd.—M. Berthelot.—The author evaporated aldehyd in hydrogen, obtaining a gas formed of 5 volumes of hydrogen and 2 of aldehyd. This mixture was heated to dull redness for half-an-hour. At the end of this time the aldehyd was decomposed into carbonic oxide and formen. A sixth part had resisted decomposition, and another sixth part had disappeared.

Ammoniaco-Magnesian Phosphate.—MM. A. Millot and Maquenne.—When an excess of a magnesian salt is added to a solution of the ammoniaco-magnesian phosphate in citrate of ammonia the whole is precipitated. This property completely justifies the process for the determination of phosphoric acid proposed by Joulie (*Moniteur Scientifique*), but it also shows the impossibility of determining magnesia in the state of ammoniaco-magnesian phosphate in solutions containing citric acid.

Annalen der Physik und Chemie, von Dr. J. C. Poggendorff, No. 3, 1875.

Contributions to Electro-Dynamics.—F. Zöllner.

Proportion of Temporary Magnetism to the Magnetising Force, and its Relations to the Reciprocal Action of the Metallic Particles.—E. Börnstein.

Remarks on the Treatise of Dr. Streintz on the Suppression of the Torsion-Vibrations of Wires.—O. E. Meyer.

Resistance of Transit at the Points of Contact of Metallic Conductors.—F. C. G. Müller.

The Specific Heats of the Elements Carbon, Boron, and Silicon.—H. F. Weber.—(First treatise: the dependence of the specific heat of the isolated elements, carbon, boron, and silicon on temperature.)

Passage of the Rays of Light through a Spectroscope.—J. L. Hoorweg.

Unipolarisable Electrodes.—A. Overbeck.

Conduction of Electricity in Electrolytes.—W. Bietz.

Sequel to Essay on the Apparent Position of a Point of Light Existing in a Denser Medium.—K. L. Bauer.

General Theorems on the Images of Spherical Mirrors and Lenses.—K. L. Bauer.

Theory of the Assimilitative Process in the Vegetable World.—E. von Benkovich.

Simple Procedure for Discovering the Poles of a Bar-Magnet.—C. G. Müller.

Determination of the Speed of Light and the Parallax of the Sun.—A. Cornu.

No. 4, 1875.

Unipolar Electro-Conductivity through Gaseous Strata of Different Conductive Power.—C. Braun.

New Studies on the Currents of the Electric Machine.—F. Rossetti.

Remarks on Helmholtz's Doctrine of Vowels.—E. v. Qvanten.

Specific Heats of the Elements Carbon, Boron, and Silicon.—H. F. Weber.—First treatise: (Dependency of the specific of the isolated elements—carbon, boron, and silicon—on temperature. Conclusion.)

Theory of Anomalous Dispersion.—H. Helmholtz. Electric Falling Machine.—H. Waldner.

Experimental Determination of Diamagnetism by its inductive Action.—A. Töpler.

Optical Method of Studying the Vibrations of Rigid Bodies.—O. N. Rood.

New Species of Variation-Tones.—V. Dvorak.

Spectrum of the Zodiacal Light.—A. W. Wright.

Remarks on Thomson's Electrometer.—K. A. Holmgren.

Electroscopic Notice.

Reimann's Farber Zeitung, No. 9, 1875.

This number contains a continuation of the article on the new colour, "eosin," which we shall give in full when complete.

There is a notice of the Belville steam-boiler, and its use in dye-works; receipts for an iodine-green on linen yarn: a reddish mode, a cinnamon, and a bluish green on wool; a bismarck on woollen yarns; and a chocolate, a black, and an orange on gloves.

No. 10, 1875.

This number contains complaints of the suicidal competition prevailing among the Berlin dyers; instructions for dyeing a *Vert St. Privat* on cotton yarn; an aniline and a Nicholson blue on silks; a green, a Russian green, an aniline blue, and a Nicholson blue on gloves; a corinth, a cerise, and an olive green on woollen yarn; and a light and dark vat-blue on calico, topped with Nicholson blue.

MISCELLANEOUS.

Popular Science with a Vengeance.—It is one of the most hopeful signs of the times that everybody is now supposed to know a little science. Some of us know a very little. Others know a good deal, but the arrangement is somewhat confused. We scarcely know to which class the compiler of the "Yorkshire Exhibition Guide" belongs. Whatever amount of scientific knowledge he possesses, he certainly has the art of "combining his information," and presenting it to his readers in a fresh, cheerful, and interesting manner. He says:—"A medal and plate formed of the new metal, palladium, will be interesting to scientific men. The discovery of this metal by Professor Graham a few years ago finally settled the long-disputed point as to whether or not the gas hydrogen was a metal. He proved that palladium was simply hydrogen condensed. This may be easily exemplified by placing a piece of the metal under the receiver of an air-pump and exhausting the air. The solid metal at once flies off as a gas, and on re-admitting the air it shrinks again into its former size. The little medal shown contains 100 times its volume of the gas." We will only add, in transferring this gem to our columns, that we hope it is not a fair sample of the teaching at the Leeds Mechanics' Institute—the worthy object for whose benefit the Yorkshire Exhibition is being held.—*Iron*.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of artificial fuel. Hunter Henry Murdock, patent agent, Staple Inn, Middlesex. (A communication from William Charles Arthur Röttger, Brussels.) July 20, 1874.—No. 2533. This invention relates to the manufacture of artificial fuel from coal-dust, saw-dust, peat, tan, or other matters. According to this invention a hydraulic cement is made from a mixture of ferruginous Tournay lime or its constituents (or lime containing only minute traces of alumina and iron), and silicate of soda, or silicate of potash, with excess of alkali. This cement and powdered unslaked poor lime are added to the coal-dust or other matter and intimately mixed, the mixture being moistened with water, and afterwards pressed into blocks. When these blocks are to be transported to a distance they are hardened by dipping them into a bath of silicate of soda or silicate of potash.

Improvements in the preparation of phosphate salts. Major-General Henry Young Darracott Scott, C.B., Ealing, Middlesex. July 22, 1874.—No. 2568. The object of this invention is the preparation of phosphate salts suitable for the extraction of ammoniacal compounds, and for the manufacture of manure.

Improvements in the manufacture of prussiate of potash and prussiate of soda, and in the means employed for collecting and utilising the gases and other substances emitted in the manufacture thereof. Samuel Nield and Benjamin Foster, both of Leeds, York. July 27, 1874.—No. 2624. The gases, animal, and other matters are drawn through pipes into a receiver containing a solution of alkali acid, pure water, or their equivalents; after passing through, a deposit is left, consisting partly of animal colouring matter and potash. This deposit is used again, or for dyeing or other purposes.

Improvements in apparatus for receiving and treating human excreta, and in the composition of the disinfecting and deodorising powder used therein. James Alexander Manning, Southampton Buildings, Middlesex. August 1, 1874.—No. 2676. This invention has for its object the sanitary improvement of towns and cities, and of dwellings in country districts, by cutting off all communication between the closets and sewers or cesspools, and the substitution for water closets of dry closets of a peculiar construction and arrangement, whereby the liquid and solid excreta are separated from each other, and collected in separate receptacles along with disinfectants, deodorisers, and absorbents, composed of soot, wood charcoal, seaweed charcoal, animal charcoal, or phosphate of lime, sulphates of manganese and of iron.

Improvements in the manufacture of solvents for certain resins and gum-resins. Murdock Mackay, chemist, Mark Street, Finsbury, London. August 5, 1874.—No. 2709. Adding to methylated spirit (or a mixture of pyroxilic spirit and alcohol) one or other of two certain combinations, and stirring till the spirit becomes milky-white or of a milky appearance, and then adding more of the methylated spirit (or of the said mixture) till it becomes clear. The combinations I term No. 1 and No. 2. No. 1 consists of 1 part of benzoline to 6 parts of mineral or coal naphtha; or 1 part of turpentine to 6 parts of mineral or coal naphtha; or half one part of benzoline and half one part of turpentine may be substituted for one whole part of either. No. 2 consists of 1 part of turpentine to 3 parts of benzoline. The proportions stated may be varied, and in some cases I use mineral or coal naphtha only instead of combination No. 1.

NOTES AND QUERIES.

Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Coal-Gas.—Will any of your readers give me an account of parties who, at various times, have tried the experiment of making their own gas for private use, and whether it is considered practicable in private houses? I would also be glad to know the heating power of creasote over that of coal.—JAMES HOOPER.

Rusting of Iron.—Could any of your correspondents inform me what means should be taken to prevent iron employed in breweries from rusting when in contact with water? Would silicated paints do? Something that does not taste the ale would be required.—BREWER.

MEETINGS FOR THE WEEK.

TUESDAY, June 1st.—Zoological, 8.30.

WEDNESDAY, 2nd.—Microscopical, 8.

THURSDAY, 3rd.—Royal, 8.30.

— Royal Society Club, 6.30.

— Chemical, 8. "On the Effects of Pressure and Cold upon the Gaseous Products of the Distillation of Carbonaceous Shales," by J. J. Coleman. "On the Agricultural Chemistry of the Tea Plantations of India," by Dr. Campbell Brown. "On the Structure and Composition of Pseudomorphic Crystals having the Form of Orthoclase," by J. A. Phillips. "On Nitrosyl Bromide, and on Sulphur Bromide," by M. M. Pattison Muir. "On the Action of Chlorine on Pyrogallol," by Dr. Stenhouse and Mr. Grove. "On some New Derivatives of Alizarin," by W. H. Perkin. "On some Metallic Derivatives of Coumarin," by R. Williamson. "Note on the Action of Chlorine on Acetamide," by Dr. E. W. Prevost. "On the Action of Dilute Mineral Acids on Bleaching-Powder," by Ferdinand Kopfer. "Note on Sulphate of Narceine, and other Narceine Derivatives," by Dr. Wright and Mr. Beckett.

FRIDAY, 4th.—Royal Institution, 8.

— Geologists' Association, 8.

TO CORRESPONDENTS.

J. Walton.—See announcement under the heading "Notes and Queries."

Booth and Garrett (Philadelphia, U.S.A.), S. Cabot, jun. (Boston, U.S.A.), C. A. Bell, W. N. Harley, J. Steiner.—Received with thanks.

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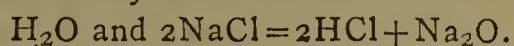
THE CHEMICAL NEWS.

VOL. XXXI. No. 810.

DECOMPOSITION OF SALT BY SUPERHEATED STEAM.

By S. CABOT, Jun.,
Boston, U.S.A.

THE apparatus used was a cylindrical stove made of cast-iron pipe, and so arranged that all the doors and the top could be closed by iron flanges and air admitted below the grate through a tube, while the products of the decomposition could be taken out above by another. A hot anthracite fire was kindled (without the use of wood, to prevent any alkaline ashes), and a stream of mixed air and steam was blown in by a very simple little tin injector, formed by inserting a fine jet of steam half way into an open cone of tin in the shape of a funnel. The writer has found by experience that a fire may be kept alive for a long time by the blast of mixed air and steam resulting from such an injector, and believes that, by passing the blast through a sufficiently long iron tube, the air would be sufficiently dry to support combustion for an indefinite length of time, and might be used with advantage in many cases where a blast is required. In this case, however, the steam was a more important ingredient than the air. While the fire was still very hot, and the blast passing through it, about a pound of salt was thrown in at the upper door, which was quickly closed. Volumes of hydrochloric acid streamed from the upper tube and were collected in water and tested. The ashes, upon examination, also were found to be alkaline, as should be the case if the reaction is, as usually formulated—



Of course, the yield was no approach to the theoretical one, and could not be applied as a technical process.

REPORT ON THE DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from page 231).

FOR the same reason, a cheaper oxide, as, for instance, oxide of copper, which Böttger proposes,† offers but little advantage, especially as a higher temperature is required for its decomposition.‡ The trouble of preparing a clear solution of chloride of lime may be dispensed with if, as Stolba suggests, a piece of paraffin of the size of a pea be added to the turbid solution.¶ The thin layer of oil upon the surface prevents frothing. One difficulty yet remains to be removed. Chloride of lime requires considerable quantities of water for solution, and large vessels are, therefore, required for preparing moderate quantities of oxygen. A. Winkler,§ therefore, dispensed with chloride of lime, by using a thick milk of lime with a little salt of cobalt, and treating the mixture with chlorine. By means of this modification, a larger volume of oxygen is evolved with the same vessels, and all danger of frothing over is avoided.

* "Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends."

† Böttger, *Journ. Prakt. Chem.*, xcv., 375.

‡ Reinsch, *Neue Fahr. Pharm.*, xxiv., 94.

¶ Stolba, *Journ. Prakt. Chem.*, xcvi., 309.

§ A. Winkler, *Journ. Prakt. Chem.*, xcvi., 340.

The part played by the metallic oxide in these methods is readily intelligible. It serves as a carrier of oxygen, passing alternately to a higher, readily decomposable, stage of oxidation, and then returning to its original state. The hypochlorous acid of the chloride of lime converts the sesquioxide of cobalt into an unstable cobaltic acid, which is immediately resolved into sesquioxide of cobalt and oxygen—



Thus, one part of the above-stated problem is solved, and the developer of oxygen is re-formed by the very act of developing oxygen. Still the oxygen is obtained, not from the atmosphere, but from the chloride of lime. The solution of chloride of calcium formed must be removed, and replaced by milk of lime. The process, therefore, is not continuous, and in this respect there is still room for economic simplification.

This, also, has been achieved, and by means of experiments which lead us back from the moist to the dry way. Since 1851,* Boussingault has brought baryta into use as a bearer of oxygen, heating it to redness in porcelain tubes, and treating it with moist air free from carbonic acid, by which it is converted into peroxide of barium. By means of a current of watery vapour, it is re-converted into hydrate of baryta, and oxygen is liberated. An addition of lime or magnesia prevents any incipient fusion, and 75 grms. of baryta yield on each operation 4 to 5 litres of oxygen. Gondolo† improved this method in 1868, replacing the porcelain tubes with iron ones, protected by magnesia within and by asbestos without, and laid in suitable furnaces, whose temperature was regulated by dampers, and adding to the baryta a little manganate of potash as well as lime and magnesia. In this manner as many as 122 alternate oxidations and deoxidations were conducted in the same tube. Whether, however, it be due to the high temperature, or to other drawbacks which stand in the way of the industrial application of this method, it has not yet found its way into actual practice.‡

(To be continued).

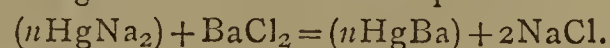
ON THE PREPARATION OF METALLIC BARIUM.

By SERGIUS KERN, St. Petersburg.

THIS metal is usually obtained in a pure state by the decomposition of barium chloride by means of a strong galvanic current; but this method requiring a powerful battery, is very expensive. For the purpose of studying the properties of barium, the following methods were used:—

1. Metallic barium was obtained by strongly heating barium oxide (BaO) with metallic potassium, from which the barium was extracted by mercury; the received barium amalgam was heated, the mercury distilled over and pure barium was obtained.

2. Barium was also obtained in the form of mercury amalgam by a double decomposition of a concentrated solution of barium chloride in water, and of sodium-mercury amalgam as shown in the equation—



As a small quantity of metallic sodium may remain free during this reaction, it is better to take an excess of barium chloride; in this case a pure barium-amalgam is obtained. The amalgam is quickly washed from the sodium chloride in a cup with water, dried and heated to set free the mercury. A description of this process may be found in every manual of chemistry. It is understood that by washing the barium-amalgam by water we oxidise in the same time the barium, which readily decomposes water, with evolution of hydrogen and formation of barium hydrate (H_2BaO_2); so that if we perform the operation of

* Boussingault, *Comptes Rendus*, xxxii., 261 and 821.

† Gondolo, *Comptes Rendus*, lxvi., 488.

‡ Robbin, *Pogg. Ann.*, cxxii., 256.

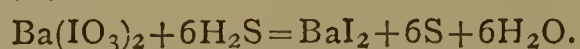
washing the amalgam very quickly, even then we loose a considerable quantity of metallic barium. However, this process for obtaining barium is a difficult one; the only modification which may be proposed is to collect as quickly as possible the barium-amalgam, to dry it between filtering paper and to heat it strongly; then the mercury and the sodium chloride in the form of vapours fly away. The specific gravity of the barium obtained by the processes mentioned above was found to be 3.75; it is a whitish metal, slightly volatile; the dry atmosphere has no action upon it, but it is readily oxidised at ordinary temperatures by water, with the formation of H_2BaO_2 . The metal seems to be rough and ductile. Ordinary acids attack the metal, with the formation of corresponding salts.

I propose a far easier method, consisting in the preparation of pure barium iodide (BaI_2) and obtaining the barium by the decomposition of the barium iodide by means of metallic sodium. The operation may be divided into two distinct parts.

1. *Preparation of Pure Barium Iodide.*—This salt may be prepared by acting on barium hydrate by iodine; the operation is made in water, slightly heated by a spirit lamp. We obtain then two salts, iodate of barium [$\text{Ba}(\text{IO}_3)_2$] and barium iodide (BaI_2) by the reaction—

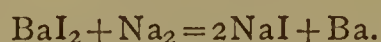


The $\text{Ba}(\text{IO}_3)_2$ is decomposed into BaI_2 by passing a current of sulphuretted hydrogen through the solution; we obtain then—



The barium iodide is filtered from the sulphur, evaporated, and dried.

2. *Preparation of Barium.*—The barium iodide is powdered and mixed with an equivalent quantity of sodium. The mixture is thrown into a covered iron crucible and heated. Strong reaction takes place with the evolution of heat and light; the reaction is a very simple one—

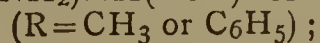


The pure metal may be extracted from the mixture by means of mercury and distilling the barium-amalgam. By this process the barium was obtained in a more compact mass. In all the experiments a strict analogy was observed between metallic barium and calcium; strontium may be supposed to resemble much these two metals, but the difficulty of obtaining the strontium in a pure state was an obstacle in studying the properties of this metal.

ON THE ACTION OF REDUCING AGENTS UPON NITRANILIDES OF SALICYLIC ACID.

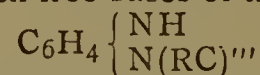
By CHICHESTER A. BELL, M.B.

IN CHEMICAL NEWS, vol. xxix., p. 167, and vol. xxx., p. 212, I have described the action of reductants on benzonitrilide and benzonitrotoluide. The experiments there detailed are supplementary to those published some time ago by Hobrecker,* and recently by Hübner and others;† and the joint results furnish perhaps the strongest argument in favour of the "ortho" (using this word in the so-called physical sense) constitution of the recently discovered nitraniline melting at 70° C. Hobrecker and Hübner have shown that nascent hydrogen does not remove the oxygen of the benzoic or acetic radicles, when these are substituted for an atom of typical hydrogen in β nitraniline (para-nitro-amido-benzol), but that a diamine of the form $\text{C}_6\text{H}_4(\text{NH}_2)\text{NH}(\text{RCO})$ results—



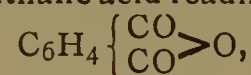
while I have proved that the same holds true for the benzoic derivatives of α (meta) nitraniline and of the nitrotoluidine obtained by partial reduction of solid dinitro-

toluol. With regard to this latter it is to be remarked that Wurster (*Berichte*, vii., 148) has proved it to be a methyl derivative of α nitraniline. On the other hand, Hübner states (*loc. cit.*) that when tin and hydrochloric acid act on similar derivatives of ortho-nitraniline (F. P. 70° C.), oxygen free bases of the form



are at once formed without any intermediate product. These he has termed anhydro-acetyl and anhydro-benzoyl-diamido-benzol.

Assuming, then, the existence of a benzol "ring," these remarkable differences can be most naturally referred to the proximity, or ortho position, of the nitro and amido groups in the latter nitraniline; for, according to present views, the three points of attraction of the reduced acid radicles $\text{CH}_3 - \text{C}'''$ and $\text{C}_6\text{H}_5 - \text{C}'''$ belong in each case to one carbon atom, which must therefore stand in direct relation with both nitrogen atoms in the diamines. This, we may presume, could only be possible in an ortho diamine. The reasoning here is precisely similar to that by which phthalic acid is regarded as an ortho derivative. As is well known phthalic acid readily yields an anhydride



while its isomers, terephthalic and isophthalic acids, do not.

With the object of contributing additional proofs in support of these views, I have examined the action of reductants on the α and β nitranilides of salicylic acid. The former of these nitramides has already been obtained by Wanstrat* by the action of phosphorus trichloride on a mixture of salicylic acid and metanitriline (from common dinitrobenzol). To the description of it which he has given I have only to add that it possesses well-marked acid properties, dissolving in cold dilute alkalis; from these solutions it is again precipitated by acids. It also decomposes sodium carbonate at a boiling heat to form a crystallisable sodium compound. Advantage may be taken of this property to purify it from a black substance which sometimes accompanies it, and which cannot be removed by crystallisation. Although very sparingly soluble in cold alcohol, it is abundantly taken up by alcoholic ammonia: but on evaporation the ammonia is entirely expelled. It is best crystallised from glacial acetic acid.

By tin and hydrochloric acid it is slowly dissolved, a crystalline double salt separating on cooling. This must be re-dissolved by addition of water, and the liquid freed from tin by sulphuretted hydrogen. To the filtrate from the tin sulphide potash must be cautiously added, as the precipitate at first formed is readily soluble in excess. The resinous mass thus obtained must be repeatedly crystallised from boiling water, with addition of animal charcoal. The same compound is more readily formed by treating the alcoholic ammoniacal solution of the nitranilide with sulphide of hydrogen. The residue left on evaporation may be at once crystallised from boiling water. From this the base is deposited in colourless micaceous crystals, fusing at 143° C. It is slightly soluble in cold water, very soluble in alcohol. Analysis agreed closely with the formula $\text{C}_6\text{H}_4(\text{NH}_2)(\text{NH}, \text{C}_7\text{H}_5\text{O}_2)$. It is not only a powerful base yielding sparingly soluble salts with acids, but it also dissolves readily in alkalis, even in very dilute aqueous ammonia. This latter solution, freed from excess of ammonia by standing over sulphuric acid, gives precipitates with salts of the heavy metals. On evaporation the ammonia is completely expelled. The acid properties in these and the following compounds are manifestly due to the hydroxyl of the salicyl radicle, $\text{C}_6\text{H}_4(\text{OH})\text{CO}'$.

The para (formerly ortho) isomers of the foregoing compounds are easily obtained by similar processes from para-nitraniline (fusing-point 146° C). The paranitrilide of salicylic acid, even after repeated crystallisations from

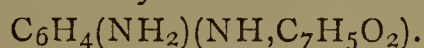
* *Berichte der Deutsch. Chem. Gesell.*, 1872, 920.

† *Berichte der Deutsch.*, 1873, 798 and 1128; 1874, 1314; 1875, 471.

* *Berichte*, 1873, 336.

alcohol, forms slightly brown platy crystals, insoluble in boiling water, but much more soluble in alcohol and acetic acid than the corresponding metanitrilide. It melts at 229° – 230° C., while the α compound melts at 218° – 219° C. In other respects the two are very similar. Its analysis agreed accurately with the formula $C_6H_4(NO_2)(NH, C_7H_5O_2)$.

Even after prolonged treatment of a solution of it in alcoholic ammonia with sulphide of hydrogen, the greater part of the base is unaffected, only a small portion being converted into brown resinous products. By tin and hydrochloric acid with some alcohol it is quickly dissolved, and the solution deposits on cooling a crystalline precipitate containing but little tin. From this it may be freed by treating its alcoholic solution with sulphide of hydrogen. To the filtrate from the tin ammonia is added in slight excess, and the whole brought to dryness on the water-bath. The ammoniacal compound at first formed is thus decomposed, and the residue, consisting of the free base and ammonium chloride, may be at once crystallised from boiling water. Thus obtained, salicyl-paraphenylen-diamin crystallises in brilliant pale straw-coloured needles, which melt at 158° C. Its analysis agreed fairly with the formula



By way of control a portion was converted into a platinum salt. Found 22.22 per cent Pt; calculated for $2(C_6H_4(NH_2)NH, C_7H_5O_2.HCl).PtCl_4 = 22.69$. From its meta-isomer it is distinguished by its very slight solubility even in boiling water and by its feeble basic properties. It is unaffected by dilute acids, but dissolves readily in very dilute ammonia. From this solution hydrochloric acid precipitates a very sparingly soluble hydrochlorate.

The reduction of the ortho-nitrilide would be of peculiar interest, for the hydroxyl group of the salicylic acid, in consequence of its ortho position, might enter into the reaction. I have not yet succeeded in obtaining it by the action of nitric acid on the anilide.

Stevens's Hospital Laboratory, Dublin.

LABORATORY NOTES.

By THOMAS GARSIDE, F.C.S.

1. Colour produced by Nessler Test in Water containing Soluble Sulphides.

If Nessler test is added to water free from ammonia, but containing hydro-sulphuric acid or an alkaline sulphide, the colour produced is identical with that given by ammonia, provided the quantity does not exceed what is necessary to produce a colour equal to 0.05 m.grm. of ammonia in 50 c.c. water. Above this the colour becomes blacker, and very soon the precipitating point is reached. The effect may easily be distinguished from that produced by ammonia, as it does not disappear on neutralising with hydrochloric acid. If the two occur together, the difference in colour before and after the addition of hydrochloric acid will serve to show the amount of ammonia present. Under certain circumstances this might perhaps be made available for the estimation of minute quantities of sulphides and sulphites.

2. Action of Nessler Test on Rain-water.

Whenever I have applied the Nessler reagent direct to rain-water, there has invariably been produced a muddy appearance. Thinking that this might be owing to impurities derived from neighbouring chimnies, I collected some rain-water on the roof of the Southport Meteorological Observatory, which is situated at some distance from any houses, but without perceiving any difference in the result. When distilled the distillate gives the usual clear brown colour. I have not yet been able to find any explanation of the phenomenon.

3. Occurrence of an Intermediate Frothing Point in Determining the Hardness of certain Waters.

I have frequently noticed in applying the soap test to waters containing rather a large proportion of magnesium salts, that a slight froth begins to form which gradually increases in tenacity until nearly sufficient soap test has been added to precipitate all the lime. At this point it is sometimes so permanent as to cover the whole surface of the liquid for five minutes. On continuing the addition of the soap test, however, the disappearance of the froth again becomes sharp and decided.

4. Action of strong Sulphuric Acid, Sp. Gr. 1.843, upon certain Salts.

When 14 parts of *baric sulphate* were added to 100 parts of sulphuric acid, and the mixture rubbed against the sides of the test-tube with a glass rod, a nearly clear solution was effected after some time. When the temperature of this was raised to 100° C., needle-shaped crystals were produced in large quantity; at 160° to 180° these entirely disappeared, but others of prismatic shape began to form, and increased in quantity as the temperature approached the boiling-point of the acid. At a boiling heat 100 parts of the acid retained between 8.5 and 9 parts of the salt in solution. When the mixture was cold, the whole of the salt re-dissolved upon stirring, and a perfectly clear solution was obtained.

The needle-shaped crystals which formed at 100° did not re-dissolve in the cold acid.

Strontic sulphate was soluble to the extent of 14 parts in 100 parts of acid at 70° C. If the temperature was lowered from this point, tabular rhombic crystals were produced; if it were raised, others having the form apparently of cube and octahedron were deposited.

Anhydrous *calcic sulphate* added to sulphuric acid in the proportion of 8.25 parts to 100, was converted at 15° C. into needle-shaped crystals. These disappeared and complete solution was effected at about 70° C. On continuing to raise the temperature, at a little over 100° C., crystals of various shapes were deposited; these again disappeared at 160° C. to 180° C., but were again thrown down at 200° C. and upwards.

Lead sulphate was soluble to the extent of 1.5 parts in 100 of boiling acid. When cold a few crystals were deposited, and 1.15 parts retained in solution.

THE CHEMICAL CONSTITUTION OF THE ETHYL-ETHER AND ITS CHLORINATED DERIVATIVES,

VIEWED AND INTERPRETED FROM THE STANDPOINT OF THE
"TYPO-NUCLEUS" THEORY.

By OTTO RICHTER, Ph.D.

THE profound and extensive researches of Professors Jacobsen, Lieben, Abeljanz, and other distinguished analysts into the molecular structure of the ethyl-ether and its chlorinated derivatives have brought to light a great variety of striking experimental evidence, from which it is argued by Lieben and a number of those chemists who are accustomed to ponder and interpret chemical phenomena from the standpoint of the prevailing type-radical theory, that the substituted chlorine molecules are not symmetrically distributed between the two ethyl radicals which, it is maintained, are co-existing as such in the ethyl-ether. This notion of a dis-symmetrical distribution appears to derive great weight from a group of observations, all tending to the general conclusion that the five component hydrogen molecules of one of these ethyl radicals admit of being replaced by chlorine at easily realisable temperatures, while the five component hydrogen

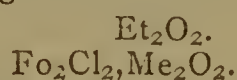
molecules of the other ethyl radical can be made to do so under the powerful influence of solar agency only. Having studied this case by the new light of my "typo-nucleus" theory, and sincerely believing that my speculative labours have been crowned with the desired success, I have deemed it my duty to submit the first fruits of these labours to the ordeal of a severe, but candid and impartial criticism. I may state beforehand that the majority of the compounds commented upon in the sequel belong to the prolific family of the acetals, whose parent molecule, the ethylen-glycolic alcohol, remains yet to be discovered.

Having now conducted the reader to the threshold of that particular compartment of organic chemistry which has served to furnish so many precious materials for carrying out the design of the present communication, I shall at once proceed to acquaint him with the leading topics of my programme, which consists of two parts. In the first part, I shall expound the molecular changes that accompany the formation of the mono- and dichlor-ethyl-ether, and dilate on the various metamorphoses which these substances are prone to experience under the influence of water or strong potash-lye. In the second part, I shall elucidate the action of sodium ethylate on the chlorinated ether and acetal derivatives, and enquire likewise into the mode of formation and molecular structure of the ether salts of ortho-formic and ortho-carbonic acids. Let us, then, enter upon the discussion of the proposed theme by examining into the leading topics of the first part of my programme.

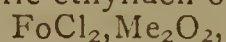
PART I.

On the Principal Molecular Changes attending the Formation of the Mono- and Dichlor-Ethyl-Ether, as also on the various metamorphoses which these substances are prone to experience under the influence of Water or strong Potash-Lye.

According to Jacobsen, the first product of the action of free chlorine on the ethyl-ether is the monochlor-ethyl-ether, to which I assign the formula*—



This formula is based upon the reasonable hypothesis that the originally-formed mono-chlor-ethyl-ether proper, Et_2O_2 , is, from its want of stability, speedily made to merge into the isomeric ethylen-oxychloride—



which, by combining, on the part of its principal, with a molecule of unaltered ethyl-ether, gives rise to Jacobsen's compound. Upon this view, the general correctness of which I hope to demonstrate in the sequel, it will be seen that the primary chlor-ethyl-ether comports itself precisely

like the similarly-constituted chlor-ethyl-chloride, E_2Cl_2 , which, from its great readiness to pass into the isomeric ethylen-dichloride, $\text{Fo}_2\text{Cl}_2, \text{Me}_2\text{Cl}_2$, is likewise unknown

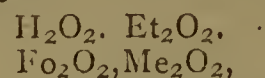
* The marks of punctuation are symbols of molecular grouping. Thus, a dot connects a base with its acid; a semi-colon, the hydrocarbon adjunct with its principal; and a comma, the halogen adjunct (which may be a mono- or poly-atomic acid, base, or salt) with its principal. In the chemical formulæ (generally the double of the ordinary formulæ) the non-essential constituents are placed above the essential constituents, while the notation is simplified by means of symbols representing hydrogen and bicarbon nuclei variously modified by their chemical union with different hydrocarbon adjuncts. These nuclei must not be confounded with the compound radicals of the dominant system, with which they have nothing in common but the names. Dashes placed above these symbols indicate the number of substituted chlorine molecules in the associated hydrocarbons. The following is a list of the symbols embodied in the formulæ of the text:—(1) Formyl in the two isomeric modifications, $\text{Fo}_2=2\text{C}_2; \text{H}_2$

and $2\text{Fo}=2\text{H}; 2\text{C}_2$ (chlor-formyl: $2\text{Fo}=2\text{Cl}; 2\text{C}_2$) ÷ (2) semi-formyl:

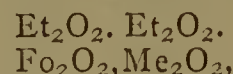
$\text{Sfo}_2=2\text{C}; \text{H}_2$ ÷ (3) methyl: $\text{Me}_2=2\text{H}_2\text{C}_2; \text{H}_2$ (chlor-methyl: $\text{Me}_2=2\text{HC}_2\text{Cl}; \text{H}_2$ ÷ dichlor-methyl: $\text{Me}_2=2\text{C}_2\text{Cl}_2; \text{H}_2$) ÷ (4) ethyl:

$\text{Et}_2=2\text{H}_3\text{C}_4; \text{H}_2$ (chlor-ethyl: $\text{Et}_2=2\text{H}_3\text{C}_4\text{Cl}; \text{H}_2$). $\text{H}_2=2; \text{C}_2=12; \text{O}_2=16$.

to us in the primitive form. On subjecting his chlor-ethyl-ether to the action of water, a product was obtained to which Jacobsen applied the term "aldehyd-alcoholate," and which is evidently—



showing it to be the mono-ethyl-ether of the missing ethylen-glycolic alcohol, while the ordinary acetal—



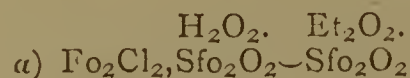
is its di-ethylic derivative. In turning to the bichlor-ethyl ether—



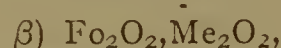
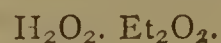
the chief decomposition products and derivatives which, according to Lieben and Abeljanz (*vide* their respective memoirs), that substance is known to yield, in contact with water or strong potash-lye, are found to be the hydroxyl-chlor-ether in two isomeric modifications, chlor-acetaldehyd, oxy-acetaldehyd, and ethylic alcohol (I shall pass over a condensation product of the hydroxyl-chlor-ether).

It is of importance to bear in mind that the two modes of treatment just alluded to give the same products, although in different quantitative proportions; so that the explanations I am now going to offer in connection with the second of these modes will apply equally well to the first also.

According to Abeljanz, the direct products of the action of strong potash-lye on the bichlor-ethyl-ether are chloride of potassium and the hydroxyl-chlor-ether; but, considering that this ether occurs in the two isomeric modifications—

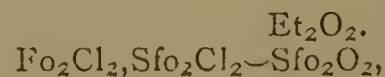


and—



it becomes incumbent on me, in justification of these formulæ, to define the precise character of the two kinds of chemical action which the alkali is held to exercise on the bichlor-ethyl-ether. If, then, a chlorine-coveting substance, like hydrate of potash, for example, is brought to bear upon a compound where, as in the case before us, the two substituted chlorine molecules belong to two locally and typically distinct groups, in which they are destined to discharge different duties and functions, the following two alternatives present themselves for our consideration.

In the first alternative, the bichlor-ethyl-ether, in virtue of a purely catalytic action on the part of the alkali, is first made to pass into the isomeric modification—

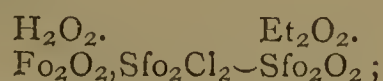


where the molecular changes consist in the splitting up of the chlor-methylen adjunct into hydrochloric acid and four univalent carbon molecules, two of which are appropriated by the acid, when the resulting semi-formyl-chloride, by allying itself with the remaining semi-formyl-oxide, gives rise to a molecule of the biatomic methylen-oxychloride, which, in conjunction with the originally-existing formyl-chloride and ethyl-ether, completes the formation of the compound in question.

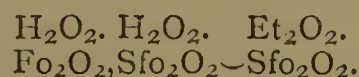
Now, it is from this modification that the α -hydroxyl-chlor-ether is finally produced, by the interchange of the semi-formyl nucleus of the principal for the potassium nucleus of the hydrate. In the second alternative, the unaltered bichlor-ethyl-ether, by the interchange of the formyl nucleus of the colligated formyl chloride for the potassium nucleus of the hydrate, gives at once rise to a molecule of the β -hydroxyl-chlor-ether.

In pondering the molecular changes that ought to accompany the catalytic action of the alkali the

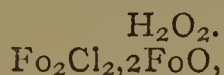
β variety, I have, further, been led to infer the existence of a γ modification—



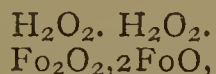
and, finally, as regards the end-product of the continued action of the alkali on either of these three varieties, I have no doubt but that it will be found one and the same, viz., the ethyl-ether of the triatomic ethylen-glycolic alcohol—



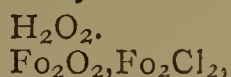
It is upon the basis of the preceding formulæ that the simultaneous occurrence of chloracetaldehyd—



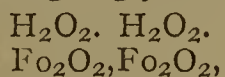
and oxy-acetaldehyd—



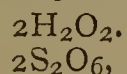
on the one hand, and of ethylic alcohol on the other hand, may be satisfactorily explained by the splitting-up of the α and γ varieties of the hydroxyl-chlor-ether, the former into ethylic alcohol and the ordinary chlor-acetaldehyd, and the latter into ethylic alcohol and an isomeric modification of chlor-acetaldehyd—



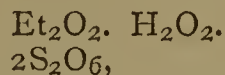
from which the oxy-acetaldehyd is then finally produced with the aid of two molecules of water, it being taken for granted that the resulting deglycolic alcohol—



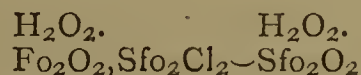
is very prone to merge into the isomeric oxy-acetaldehyd. In this view I am further confirmed by the behaviour of a concentrated solution of sulphate of water—



towards the β -hydroxyl-chlor-ether; for it appears to me that the simultaneous production of sulpho-vinate of water—



oxy-acetaldehyd, and hydrochloric acid must be due to the interchange of one of the two basic hydrogen nuclei in the sulphate for the ethyl nucleus of the β -hydroxyl-chlor-ether, which gives rise to the sulpho-vinate and the combination—



(derived from the previously-formed γ -hydroxyl-chlor-ether). But this compound is soon made to resolve itself into two molecules of water and the aforesaid variety of chlor-acetaldehyd, from which the oxy-acetaldehyd has just been said to emanate.

When, afterwards, a portion of the aldehyd, as obtained in one of these experiments, was transferred to the exsiccatory apparatus, and left to absorb oxygen from the air, the entire absence of the ordinary chlor-acetaldehyd was proved by the circumstance that the resulting glycolate failed to give the slightest indication of the needle-shaped crystals of the looked-for chlor-acetate. Nevertheless, the remaining portion of oxy-acetaldehyd, on being heated with water and oxide of silver, was observed to furnish, in addition to the bright mirror of reduced metal, a very perceptible quantity of chloride of silver.

Now it strikes me that these unexpected, and otherwise unintelligible, deviations are readily explained on the assumption that this specimen of oxy-acetaldehyd had yet been containing a small admixture of our variety of chlor-acetaldehyd, which, from its chemical constitution, ought to be perfectly passive to atmospheric oxygen; whereas the ordinary chlor-acetaldehyd, through its formous acid

principal, ought to evince, as it does, in fact, a powerful attraction for that element.

With these few theoretical hints and considerations, I shall now embark in the discussion of those weighty matters that are reserved for the second part of my programme.

(To be continued.)

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

ON Wednesday last, the 2nd inst., a general meeting was held at Cannon Street Hotel, when the chair was taken by Mr. J. A. WANKLYN, M.R.C.S., one of the Vice-Presidents.

The minutes of the last meeting having been read and confirmed, the Council presented a report on the "Sale of Food and Drugs Bill," showing the amendments it had undergone since the last meeting of the Society.

Immediately following this, Mr. WIGNER read a paper indicating the points of similarity and divergence between the old Bill and the new, and explaining the probable working of the one as compared with the other.

Considerable discussion followed, in which Messrs. Bernays, Dupré, Allen, Tripe, and several other Members took part.

Resolutions were passed instructing the Secretaries again to communicate with the Local Government Board, or to take such other steps as they should think advisable, with a view of obtaining a modification of some objectionable features still remaining in the Bill.

The following gentlemen, whose names had been printed with the circular convening the meeting, were declared by the Scrutineers appointed to examine the voting papers to have been unanimously elected as Honorary Members:—F. A. Abel, F.R.S., President of the Chemical Society; E. Frankland, F.R.S., D.C.L., &c.; W. Odling, M.B., F.R.S., &c.; A. W. Williamson, Ph.D., F.R.S., &c.

The Secretary then announced that the Council, feeling the deep obligation which the Society owed to the Right Hon. Dr. Lyon Playfair, M.P., and Dr. Chas. Cameron, M.P., for the strenuous and successful exertions which they had made in the House of Commons for the improvement of the "Sale of Food and Drugs Bill," recommended that the names of those two gentlemen be added to the list of Honorary Members, and that they be balloted for there and then.

The ballot was immediately taken, and the two gentlemen were unanimously elected.

After this, several papers were read and discussed, but we are compelled to defer a fuller report till a future occasion.

NOTICES OF BOOKS.

Introduction to Experimental Physics, Theoretical and Practical: Including Directions for Constructing Physical Apparatus and for making Experiments. By ADOLF F. WEINHOLD, Professor in the Royal Technical School at Chemnitz. Translated by BENJAMIN LOEWY, F.R.A.S. London: Longmans and Co. 1875.

THIS work is principally interesting to the chemist from the fact that it discusses a great quantity of physical work, more or less assimilable with his own work in a chemical laboratory. Yet it is not a treatise on physical manipulation alone, like the works of Kohlrausch and Pickering, which pre-suppose a knowledge of general physics, but our author has rather permitted the book

study and the practical work to go hand in hand, so that his work might almost be put into the hands of a beginner. He tells us how we may improvise numberless pieces of apparatus for which we are in the habit of paying high prices at the instrument makers, and which we never dream of making for ourselves. Practical advice is given about drilling, screw cutting, turning, &c., and a description of the various tools required. In the case of nearly all the numerous woodcuts the scale is given—"one-fourth real size," "one-eighth real size," and so on. Although the work is quite free from mathematical formulæ, a great number of simple calculations are worked out, such as the calculation of the velocity of light from the eclipses of Jupiter's satellites; and the determination of the relative intensity of different sources of light by means of Rumford's photometer. In the use of the latter the author remarks "An insurmountable difficulty in these experiments arises from the fact that two sources of light never emit light which is of equal whiteness. The light of a candle is always somewhat more reddish than that of a paraffin lamp; hence the shadow projected by the lamp—that is the portion solely illuminated by the candle—has a more reddish tinge than the other shadow, and in consequence of this difference in the colour of both shadows it is impossible to decide whether both are equally illuminated."

The work does not contain the most recent forms of apparatus in many instances; thus Winter's electrical machine is described at length, but no mention is made of the machine of Holtz or Bertsch; neither do we find mention of Thomson's galvanometer, and many other instruments. The book must not be regarded as a complete handbook of physics, but must be used with some one or other books; or better it should be worked through, and then supplemented by such a work as Deschanel. Even such important laws as Ohm's law, and Faraday's law, are no more than mentioned, and one is sometimes tempted to wonder how the 839 pages have been filled, did we not observe the minute directions which are often given for the performance of an experiment. These are sometimes almost too minute, unless the book is regarded as a text-book for those who are absolutely commencing experimental work; for example, our author writes: "Care is required in handling the acid; if a drop should get on to the clothes it should be immediately touched with solution of ammonium carbonate, which it is best to have in readiness; for as soon as the spot becomes visible it is not easy to remove it. The hands are coloured yellow by nitric acid, and the colour disappears only gradually as the destroyed skin peels off and is replaced by a new growth underneath it."

Still we commend the book to the notice of all students who are doing practical physical work; it abounds with useful hints; and we specially commend Prof. Foster's preface, which contains much valuable and suggestive matter.

The Commercial Handbook of Chemical Analysis. By A. NORMANDY. New Edition; enlarged, and to a great extent re-written, by HENRY M. NOAD, Ph.D., F.R.S. London: Lockwood and Co. 1875.

THERE are few chemists who are not acquainted with the "Handbook of Commercial Analysis," written by Dr. Normandy, which was published in 1850, and when, ten years later, the publishers announced the appearance of a new edition, many were the regrets of those who found they had purchased an exact reprint of the original work. Such a real want existed for a work of the nature of Dr. Normandy's Chemistry—but brought carefully up to the present time—that we hailed with especial satisfaction the announcement that the compilation had been undertaken by a chemist of so high a reputation as Dr. Noad.

In the work under notice, the editor has retained the alphabetical arrangement of the first edition, but the

articles have been revised, and much new matter has been introduced.

In his preface, Dr. Noad states that he has endeavoured to make the work a "Handy Book" for the efficient analyst discharging his duties under the new Adulterations Act, and therefore special interest attaches to the sections having reference to articles which come under the notice of the public analysts, and to which the editor directs attention in his preface.

In the article on bread the editor gives instructions for detection of alum, which are shortly as follows:—The bread is to be charred in platinum—carefully avoiding incineration. The charred mass is to be powdered, boiled with aqua regia, and the whole evaporated to dryness. When dry, the mass is to be boiled with concentrated solution of soda, and the solution filtered. The filtrate is neutralised with hydrochloric acid, sodium phosphate added, and then ammonia in slight excess, the resultant phosphate of aluminium being weighed. It would not be difficult to find fault with the above process on more than one ground, but the uncertainty of effecting solution of the alumina, and the liability to get silica dissolved, would make any experienced analyst very chary in relying upon results given by it, though the editor expresses his indebtedness to Dr. Tidy for the details of the method.

Under the head of butter, the author gives Dr. Campbell-Brown's process in full, and a detailed description of Mr. Allen's method of examining tea is to be found under the appropriate head.

Wanklyn's process of examining milk being now in almost universal use, we are astonished to find that the author ignores it entirely, but gives a detailed description of the old analyses of Dr. Voelcker of the milk at Cirencester. When we find that the latter chemist's notorious assertion that "milk purposely watered yields only 5 to 6 per cent of cream, and invariably has a lower specific gravity than 1.025" (!) is quoted as gospel, we cannot but feel that the much-talked-of discrepancies of chemists are often due to causes for which the leaders of the profession are responsible.

Perhaps one of the worst articles in the book is that on coffee, a considerable part of which consists of useless "padding," while true scientific information is conspicuous chiefly by its absence. For the detection of chicory, the editor appears to rely on the "cold water test," the separated chicory being "identified by its taste and pastiness," no hint at a microscopic examination being given, and no mention of the normal percentage of ash in coffee being made. Nor is there any reference to the classical report of Messrs. Graham, Stenhouse, and Campbell, or to their infusion or colour tests.

It might be expected that a work which deals with frankincense, glue, lozenges, and stick-lac, would at least treat of such everyday subjects as slags, oil-cakes, anthracene, mustard, coal, coke, petroleum, fire-clays, &c., to none of which is any reference made—though there is an appendix treating of articles accidentally omitted from the text of the book.

Having found so much occasion for adverse criticism, it is pleasant to be able to write in commendation of many excellent articles in the book, and of the general plan of arrangement. Symbols have been entirely avoided, while the compromise between the old and new nomenclature, by which chalk is called carbonate of calcium, is well adapted to meet the requirements of all classes of chemists. There is a useful glossary, which is in effect a short treatise on chemical manipulation, illustrated with some useful woodcuts.

On the whole, we can recommend the book as containing a great deal of information of a kind not readily met with, and the want of a first-rate book of the sort is so widely felt, that we trust the editor may see his way at an early date to compile an appendix treating of articles hitherto wholly omitted or but imperfectly dealt with in the present edition.

CORRESPONDENCE.

WATER ANALYSIS IN THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—In the condition into which it has fallen, the Chemical Society of London interests me very little, and, as a rule, I pay little attention to its proceedings.

But from the last CHEMICAL NEWS I learn that water analysis has been before the Society, and that a variety of misrepresentations have been made.

Possibly it may be well to correct these, and I take this opportunity of doing so.

The occasion which brought water analysis before the Society was the reading of a paper by Mr. Deering "On some Points in the Examination of Waters by the Ammonia Method," and the ammonia method (or process) of water analysis, as I need hardly say, was discovered by Chapman, Smith, and myself, eight years ago.

The first commentary that I have to make on Mr. Deering's paper is that I have difficulty in perceiving the novelty in it. That the Nessler colour takes some time to develop has been often remarked, and that by observing certain precautions in the preparation of the reagent, and in the manner of working the test, any difficulty on that score may be got over is likewise well known to many persons, but apparently not to Mr. Deering, who in this paper proposes to get over the difficulty by the use of a solution of caramel to imitate the Nessler colour. Even this proposal is not new, caramel having been used for the purpose before, and, I believe, abandoned.

That peaty waters yield albumenoid ammonia in considerable quantity is quite well known, and has been pointed out in the third edition of my book on "Water Analysis," which was published about a year ago. That there is any difficulty in distinguishing between such cases and the cases in which town sewage exists in drinking waters (which Mr. Deering appears to imply) is not true.

The commentaries on Mr. Deering's paper were just what I should have expected from the Chemical Society in its present condition. There was a caution from Mr. Hartley to keep the Nessler cylinders closed during the distillation, lest they should absorb ammonia, which he thinks might enter them even although "there might be no odour of ammonia in the room." This caution will amuse persons who have practical acquaintance with the subject, and who know that—although every vessel should be washed with abundance of water immediately before being used—yet even when there is a powerful smell of ammonia in the laboratory, there is little danger in Nesslerising in open cylinders. Another person said he had examined peaty waters, and got much albumenoid ammonia from them: but no one appears to have called attention to the circumstance that in the instance of vegetable contamination there is comparatively little free ammonia and much albumenoid ammonia, whilst in town sewage—even when highly diluted—the ratio is reversed. Neither did anyone refer to the evidence derivable from the chlorides. I have long ceased to expect anything like "insight" in the Chemical Society, and am not surprised that no one remarked on the "different distribution" of the albumenoid ammonia according to the nature of the organic substance which is present, and that this difference is especially marked between such substances as animal albumen and vegetable substances.

The observations by the President, Mr. Abel, are characteristic. I remember well, soon after we had brought out the ammonia process (which so many persons have found so very easy, so very certain, and so very regular), that Mr. Abel got up to tell the Society that he could not work it at all, and that he experienced the greatest difficulty even in the operation of Nesslerising. Remem-

bering this, I am not surprised—now that Mr. Abel occupies the President's chair—that he should find the existence of peaty matters in drinking-water a source of difficulty in the working of our process; but I do not think that the fault lies with the process.

The President's concluding remark is equally characteristic. He said, "He agreed with Mr. Thorp that the combustion method in some cases possessed considerable advantages over the Nessler test." In order that this may be intelligible it is necessary to explain that when certain chemists have occasion to speak of the process of water analysis, discovered by Chapman, Smith, and myself, they are in the habit of calling it the Nessler test, or the Nessler process. Whether, in so designating it, they are influenced by the love of brevity, or confusion, or by some other motive, need not be discussed; suffice it to note the peculiarity of expression, and to explain that the President meant that in some cases Dr. Frankland's process of water analysis will answer, and ours will not.

The defects in Dr. Frankland's water analysis were pointed out by Chapman, Smith, and myself in the year 1868, when we showed that Dr. Frankland's process is affected by such serious error as to be quite illusory. No reply has yet been made by Dr. Frankland, who was present at the meeting of the Society in which we brought forward our criticisms; and, so far as I am aware, instead of being prepared with answers to these criticisms, chemists are inclined to wonder that it should have been necessary for us to point out, in such minute detail, defects which were so very palpable.

That, in the year 1875, the person who occupies the chair at the Chemical Society should affirm the validity of Frankland's water analysis shows that our criticisms were not superfluous, and call upon us to repeat them.

Dr. Frankland's process of water analysis professes to determine the quantities of carbon and nitrogen existing in the form of organic compounds in drinking-water, and consists in making an elementary organic analysis of the solid residue left on evaporating the water to dryness in the water-bath.

In limine, there is a very obvious objection to this procedure; viz., that the organic matters present in water are alterable by prolonged exposure to the action of air and moisture at the temperature of the water-bath, and that therefore the carbon and nitrogen which Dr. Frankland's process professes to measure in the form of carbonic acid and nitrogen gas, are allowed to make their escape into the atmosphere, in various shapes, during the evaporation to dryness. When the extreme minuteness of the organic matters existing in drinking-waters is considered, and the extreme alterableness of some of them, the invalidity of the process must be quite apparent.

Looking into the subject more closely, we find almost every conceivable reason for distrusting the results. Nitrates are common in drinking-water, and, compared with the organic matter, are present in abundance, ten times as much nitric acid as organic matter being of common occurrence. In order to avoid confounding the "organic" nitrogen with the nitrogen of the nitrates, Dr. Frankland proposes to destroy the nitrates by boiling with some sulphite of soda, which he adds in the shape of sulphurous acid and carbonate of soda. But there is this difficulty to be encountered. The nitrates are not perfectly reduced unless the solution be acid; and if the solution be rendered acid, then sulphuric acid is produced, and Dr. Frankland thereby guarantees himself against all chances of correct results; for if, perchance, the organic matter in any instance should survive the operation of being heated for several hours in contact with air and moisture, he destroys it with sulphuric acid, which must become concentrated as the water residue approaches to dryness.

Dr. Frankland's water process belongs to the class of analytical methods which are affected with a high experimental error; indeed, it is quite unique in this respect, inasmuch as the experimental error amounts to about ten times the quantity to be measured. Dr. Frankland seems

to have a strange partiality for analytical methods of this description, and (as was, I believe, pointed out by Roscoe) having had occasion to estimate the carbonic acid in the air, he did it by measuring the air before and after the action of caustic potash upon it, thereby employing a method affected by an experimental (or manipulatory) error which was about as large as the entire quantity of carbonic acid existing in the air which he examined. The average quantity of carbonic acid in atmospheric air amounts to about $\frac{1}{2000}$ th of the volume of the air. Unless, therefore, the analyst can measure to less than $\frac{1}{4000}$ th of the volume operated on, the two readings required for the estimation of the carbonic acid must be affected by an error of at least $\frac{1}{2000}$ th of the volume of the air. When Dr. Frankland resorted to this doubtful method of determining the carbonic acid in the atmosphere, chemists were in possession of De Saussure's method, which is not affected by such an error.

I do not find that Dr. Frankland ever quarrelled with De Saussure, and cannot explain his rejection of the De Saussure process in favour of the one he used, unless, indeed, he prefers processes of analysis where the experimental error is high and the result illusory.—I am, &c.,

J. ALFRED WANKLYN.

SIMPLE METHOD FOR TESTING FOR POTASH.

To the Editor of the Chemical News.

SIR,—Mr. J. Steiner occupies the valuable space of the CHEMICAL NEWS (vol. xxxi., p. 231) by a reprint of a process so familiar to every chemical tyro as that of the estimation of potash by platinum chloride, with previous precipitation of sulphuric acid, &c., by baryta.

The note of Mr. J. Steiner contains no new suggestion—as he will find on reference to Fresenius (sixth English edition, pages 152 and 358).—I am, &c.,

W. T.

May 31, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 17, May 3, 1875.

Report on an Apparatus for Determining the Alcohol in Wines.—A. Malligand.—A very lengthy paper, incapable of useful abstraction.

Researches on the Phenomena Produced in Liquids by Electric Currents of High Tension.—M. G. Planté.—The author finds that the electrode which has the largest immersed surface gives its sign to the liquid of the voltmeter. He has obtained results which seem to throw light on the origin of the fire-balls, or globular lightning, sometimes observed towards the end of an electric storm.

New Source of Magnetism Noticed by M. D. Tommasi.—M. Maumené.—The author considers that M. Tommasi has not correctly interpreted the phenomenon which he observed. Heat does not act so as to constitute a new source of magnetism. It produces a thermoelectric current, and this current develops the magnetism observed.

Inverted Sugar.—M. Maumené.—The author remarks that few bodies are so difficult to incinerate as normal sugar. Inverted sugar can be burnt far more easily. The determination of the ash in crude sugars is greatly facilitated by previously inverting the sample.

Decomposition of Neutral Fatty Bodies.—M. J. C. A. Bock.—The author's process is divisible into three

stages—1. Rational acidification, having for its object to carbonise, rupture, and render permeable the albuminous envelopes of the fatty particles. 2. The fatty matter is then split up by means of acid diluted with water. The amount of acid required is about 5 per cent. 3. The fatty acid is bleached by boiling with permanganate.

New Apparatus for the Continuous Manufacture of Superphosphate.—M. P. Thibault.—This paper was accompanied with plans, which are essential to its intelligibility.

Action of Magnets upon Rarefied Gases Enclosed in Capillary Tubes, and Illuminated by an Induced Current.—M. J. Chautard.—The spectral modifications produced by the action of magnets upon the induction light traversing rarefied gases are subject to very complex laws. The most striking result is an increase of resistance on the part of the induced current under the influence of the magnet. As long as the magnet is inactive the light circulates uniformly in the two tubes. It is suddenly arrested in the shorter and narrower tube at the moment when this is submitted to the action of the magnet. The effect may be produced with chlorine, iodine, sulphur, and selenium.

Solubility of Nitrate of Soda, and its Combination with Water.—M. A. Ditte.—Nitrate of soda, like nitrate of lithia, forms at low temperatures a compound with water. Nitrate of potash presents no similar phenomenon; its solution, saturated at zero, only contains 13.3 of the salt in 100 of water. If cooled to -2° , it becomes filled with crystals of the ordinary form of nitrate of potash. If we plunge into the same freezing mixture at -13° or -14° two tubes containing solutions saturated at zero, the one of nitrate of soda, and the other of nitrate of potash, the latter in a few moments becomes a solid mass, whilst the former remains liquid, in spite of agitation and of the presence of crystals of nitrate of soda in the tube. The melting-point of the hydrate, $\text{NO}_5\text{NaO}, 14\text{HO}$, being below the temperature of the freezing mixture, it remains liquid.

Decolourising Property of Ozone.—M. A. Boillot.—One of the most striking properties of ozone is its bleaching power. The effects ascribed to chlorine are really due to ozone. Ozone employed directly acts as an oxidising agent, laying hold of the hydrogen of the substance with which it is in contact, whence results bleaching, if the body is coloured. On allowing chlorine to act upon any animal or vegetable matter, it decomposes a certain quantity of water and seizes its hydrogen, forming hydrochloric acid. The oxygen set free by this reaction is transformed into ozone, which in its turn lays hold of hydrogen present in organic matter.

Characters of Glycocoll.—M. R. Engel.—If boiled with a concentrated solution of potash or baryta glycocoll gives a blood-red colouration. If treated with sulphate of copper, and then with potash, it hinders the precipitation of the copper, giving a fine blue colouration. In the cold, and even in heat, it reduces mercurous nitrate. With perchloride of iron it gives an intense red, which disappears on the addition of an acid, and may be reproduced by cautiously neutralising the acid with ammonia. If a little glycocoll in solution is mixed with a drop of phenol and hypochlorite of soda is added, a fine blue colour appears in a few moments.

Bulletin de la Societe Chimique de Paris,
No. 6, March 20, 1875.

Researches on Albumen.—M. P. Schützenberger.—The conclusion of the author's investigations on albumen.

Monobromated and Dibromated Camphor.—M. J. de Montgolfier.—Not adapted for abstraction.

Detection of Tarry Matter in the Ammonia of Commerce.—M. Kupfferschläger.—The ammonia is gradually poured into a test-tube containing dilute nitric

acid. If tarry matters are present, a "gooseberry red" colouration makes its appearance. [This test has been in use in dye-works, &c., in England, for at least seven years.]

Identity of the Bromated Derivatives of Tetra-bromic Hydride of Ethylen, and those of Perbromide of Acetylen.—Edme Bourgoin.—Already noticed.

Mutual Displacement of Acetic and Formic Acids.—H. Lescœur.—The author has never succeeded in completely decomposing a formiate by an excess of acetic acid. The reaction is not more decided with the aid of heat than in the cold. Dilution of the acetic acid diminishes the amount of formiate decomposed.

Researches on the Selenites.—M. F. Nilson.—A memoir originally published, in the English language, in the *Transactions of the Royal Society of Sciences at Upsala*. The author considers the results of the late Dr. Muspratt inaccurate. The selenium employed was obtained from the lead-chambers of the Fahlun Work, in which it forms about 2 per cent of the mud. M. Nilson describes selenites of potash, rubidium, cesium, ammonium, thallium, sodium, lithium, and silver.

Correspondence from St. Petersburg.—M. W. Louguinine.—The author briefly notices investigations by M. Schöne, on peroxide of hydrogen in the atmosphere; by M. O. Bogouch, on the formation of aldehyds; by M. N. Beketoff, on the separation of silver from nitrate of silver by the action of hydrogen; by W. Morkownikoff, on the oxidation of α -oxybutyric acid; by Beilstein, on the production of meta-dichloro-benzin by the action of nitrous acid and alcohol upon dichloro-aniline; by M. Boutlerow, on penta-methyl-ethol; by M. Boradine, on the production of dithymol by the action of chloride of iron upon thymol, and on oxydinaphthalin obtained by distilling β -dinaphthal with anhydrous phosphoric acid.

Reimann's Farber Zeitung, No. 11, 1875.

This issue contains a notice of the manufacture of magenta, free from arsenic, by the reciprocal reaction of aniline, toluydin, and nitro-toluol, as carried on by the firms of Meister, Lucius, and Brüning, of Höchst, and the Aniline Manufacturing Company (late Dr. Jordan) of Berlin.

There are receipts for dyeing mixed doubles a light cinnamon; for a fast brown-red on wool; a fast brown-red on cotton-yarn; a chamois on cotton-wool; a pansy on gloves; and for printing a black design on a (madder) red ground.

No. 12, 1875.

This issue contains an article on patent law reform, in which the English patent laws are recommended for adoption in Germany.

Eosin.—If this colour is stirred up with water and sodium amalgam at a gentle heat the red liquid is decolourised, and colourless fluorescein produced. If this liquid is diluted with water, and a drop of permanganate added, it becomes green and opaque by reflected light, having been converted by oxidation into fluorescein.

Gris d'Aniline or Nigrosin in Silk Dyeing.—With this colour the silk dyers produce all their greys, modes, dark blues, plum-colour, and Russian green at prices very little exceeding the wood colours. The same colour-beck can be used for days. The gris d'aniline soluble in spirit is preferable to that soluble in water, as the latter is apt to come up flat in the darker shades. The operation is performed at a boil, with soap and sulphuric acid. With the addition of orchil and young fustic are produced all conceivable shades of grey, mode, and olive green. For dark greens turmeric is added, or a combination of gris d'aniline, aniline blue, and turmeric is used. The green shades may be brightened by topping with picric acid in a fresh beck. Dark blue is obtained with gris d'aniline and aniline blue. In dissolving the colour, proceed as for other aniline colours soluble in spirit, and the solution is filtered for

use. To 1 kilo. of silk are taken half a gallon of strong soap-lye (*cuite*); the beck is made up with water, 65 grms. of sulphuric acid are added, and the whole heated to 60°, and afterwards raised to a boil, without which the shades will be uneven.

There is also a method for stripping mixed (half wool) garments of an alkaline blue, and for turning them to a claret.

The new indigo vat (Schützenberger's and de Lalande's hydrosulphite process) is producing in practice remarkably good results, and promises at an early date entirely to supersede all other vats in woollen dyeing.

No. 13, 1875.

This issue contains remarks on the new indigo vat; receipts for printing a green on woollen yarns and tissues; for a black on the same material; a black on felt hats; a fast light indigo blue without indigo; and for bleaching linen and cotton.

To Prevent Boiler Incrustations.—Galls, 1 part; glue, $\frac{1}{4}$ part; soda, $\frac{1}{4}$ part. Another authority proposes to boil 30 kilos. soda, 12 kilos. potash, and 1 kilo. catechu in 20 gallons of water, and pour the decoction into the boiler.

Bang proposes to prepare soluble prussian blue, and dye wool and silk with it at a boil.

Thiré and Duport dissolve aniline colours in alcohol, mix the solution with benzol, and dye with it. A similar method can be pursued with dye-woods and astringents.

Methyl Green on Wool (50 kilos).—One-half kilo. of borax on soluble glass, 1 kilo. methyl green. Work for thirty to forty minutes at 65° R., rinse, and treat at 40° R. with 5 kilos. alum, 250 grms. bichloride of tin, and 250 grms. acetic acid. To the second dye-bath 250 to 400 grms. picric acid may be added.

Delobel proposes as a mordant for the aniline colours a mixture of sulphuric acid, turpentine, alum, and borax.

Chevreuse obtains a brown dye by beheading cock-chafers!

Les Mondes, Revue Hebdomadaire des Sciences.

No. 12, March 25, and No. 13, April 1, 1875.

These issues contain no chemical matter.

MISCELLANEOUS.

Obituary.—We much regret to hear of the untimely decease, at the early age of 27, of Mr. Samuel William Moore, L.R.C.P., F.C.S., &c., Demonstrator of Physiological Chemistry in St. George's Hospital Medical School. Mr. Moore had established for himself a reputation as a promising worker in the fields constituting the borderland between chemistry and physiology, his attainments in this branch having three years ago secured his election to the important post held by him in St. George's Hospital; his "Notes of Demonstrations" on this subject, subsequently published in our columns, constitute a valuable contribution to chemical and medical literature. Mr. Moore's first scientific paper on "Brain Crystals" was published in the *CHEMICAL NEWS* when he was little more than 18 years of age; and at the time of his last illness he was engaged on a laborious series of researches on the effects of tobacco, the British Medical Association being on the point of furnishing a considerable grant in furtherance of this object. Through the long-continued illness and premature removal of this talented student of nature, a young widow and two infant children are left wholly unprovided for and almost wholly destitute. We understand that the friends of the deceased contemplate making an appeal to the liberality of the medical profession and the scientific public with a view to raising a fund for the benefit of his family. The following gentlemen have kindly consented to form a committee for this purpose:—Dr. Barclay, St. George's Hospital; Dr. Bott,

20, Kennington Park Road, S.; J. Croft, Esq., St. Thomas's Hospital; W. M. Ord, Esq., St. Thomas's Hospital; G. D. Pollock, Esq., St. George's Hospital; Dr. Wadham, Dean of the Medical School, St. George's Hospital, W.; Dr. C. R. A. Wright, St. Mary's Hospital, W. (Hon. Treasurer). Subscriptions in aid of this object will be gladly received by Dr. Wadham at the above address; we have much pleasure in cordially recommending the case to the benevolence of our readers.

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

Improvements in the manufacture of soda and potash. John Henry Johnson, Lincoln's Inn Fields, Middlesex. (A communication from Hermann Gruneberg and Julius Vorster, both of Kalk, Germany.) July 28, 1874.—No. 2639. This invention relates to the manufacture of soda and potash, and consists in causing superheated steam to pass over a mixture of common salt and alumina, or hydrated alumina if soda is to be produced, and over a mixture of chloride of potassium and alumina, or hydrated alumina if potash is to be produced, the same being maintained at a high temperature.

Improvements in the treatment of saccharine solutions. John Henry Johnson, Lincoln's Inn Fields, Middlesex. (A communication from Léon Maron, Paris.) August 5, 1874.—No. 2713. The essential feature of this invention consists in raising the saccharine solutions to a boiling temperature, and then adding thereto or bringing the same in admixture in another vessel with a solution of lime or baryta, and then adding an alkali, either soda, potash, or ammonia, the same being by preference free from carbonates.

Improvements in separating the hair or wool from fresh or dry skins, and preserving the hair or wool in its natural state as if cut from a live animal. Joseph Lambert De Montoisson, Thurloe Square, South Kensington, London. August 8, 1874.—No. 2746. The inventor separates the hair or wool from skins by softening the fresh or dried skins with warm water, and then covering the flesh side of the skin with a pentasulphite composed of hydrosulphite of soda, sulphate of arsenic green potash, hydrosulphate of barium, and hydrate of fresh lime, which penetrates the thickest of skins almost instantly.

A new or improved fuel for metallurgical and other purposes. George Gordon de Luna Byron, Chancery Lane, Middlesex. (A communication from C. Edwards Lester, New York, U.S.A.) August 8, 1874.—No. 2751. Desulphurising and dephosphorising coal or its refuse when placed in union with any other substance or substances. The production of solid hydrocarbon by the union of hydrogenous and carbonaceous substances, when said substances are treated chemically and mechanically.

An improved tonic preparation of liquid extract of beef or meat. Edward Theodore Digby, Christopher Gandy, William Foyl, jun., and Edward Barry Allinson James, constituting the firm of Digby, Gandy, and Co., Liverpool, Lancaster. (Partly a communication from Joseph James Livesey, Montreal, Canada.) August 13, 1874.—No. 2799. The features of novelty which constitute this invention consist of an unproved tonic preparation of liquid extract of beef or meat, the ingredients of which are wine or other alcoholic liquor, glycerin, and extract of beef or meat (which may be prepared in manner similar to the Liebig system), syrup, quinine, or tincture of Peruvian bark, flavouring consisting of nutmegs, cloves, cinnamon, or other suitable spices.

Improvements in the method of and apparatus for obtaining ammonia from waste products and other matters. Henry Michael, patent agent, Fleet Street, London. (A communication from Joseph Alfred Ferdinand Lair, Boulevard St. Martin, Paris.) August 13, 1874.—No. 2802. The invention is especially applicable for treating waste products, the refuse heat and deposits being utilised, and offensive smells removed; pumps, heaters, and separating vessels are combined with the distilling column into which the liquid whence the ammonia to be extracted is driven, after passing through tubular heaters heated by the freed liquid from the distilling column. Steam and lime-white are introduced into the distilling column, the liquid from which passes into a separator fitted with an internal vane, at the bottom of which the deposits are left; the ammoniacal vapours pass into the sulphuric acid vessels through tubes heated by steam-pipes. To remove offensive vapours, the gases are carried under the generator-furnace. The pumps are regulated so as feed the liquid and lime-white in proper portions.

MEETINGS FOR THE WEEK.

MONDAY, June 7th.—Royal Institution, 2, (General Monthly Meeting).

TUESDAY, 8th.—Anthropological Institute, 8.

Photographic, 8.

WEDNESDAY, 9th.—Geological, 8.

THURSDAY, 10th.—Royal, 8.30.

FRIDAY, 11th.—Astronomical, 8.

Quekett Club, 8.

Anthropological, 7.30.

SATURDAY, 12th.—Physical. "On the Electrical Conductivity of Graphite," by Mr. Wildman Whitehouse. "On the Time Required for the Double Decomposition of Salts," by the President.

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THE CHEMICAL NEWS.

VOL. XXXI. No. 811.

ON THE DETERMINATION OF CARBONIC ACID WITH SCHEIBLER'S APPARATUS.

By R. WARINGTON.

WISHING to ascertain whether a speedy and accurate analysis of tartar might not be accomplished by neutralising the tartar, evaporating to dryness, igniting the residue, and determining the quantity of carbonic acid in the ash, I naturally sought, in the first place, for some good and speedy method of determining carbonic acid. Scheibler's volumetric method being largely used, and well recommended, at once suggested itself as suitable for my purpose. Mr. W. E. Halse, on learning my wishes, very kindly placed a Scheibler's apparatus at my disposal. The experience gained while using the apparatus has, I think, brought to light a rather considerable error which is involved in the ordinary practice with this instrument; this point I propose now to consider, reserving the results obtained with regard to tartar for a paper to be read shortly at the Chemical Society.

As I write for those using the apparatus, a description of the ordinary process will be unnecessary. In Scheibler's pamphlet* accompanying the apparatus, instructions are first given for the determination of carbonates in bone charcoal, and afterwards the general determination of carbonic acid by means of the apparatus is described: we will consider the latter instructions first.

The carbonate to be analysed is placed in the generating bottle, and acted on by 10 c.c. of hydrochloric acid, sp. gr. 1.12, contained in a tube which is overturned after the bottle is closed; the gas evolved is then measured over water in the graduated tube of the apparatus. It is evident that the whole of the carbonic acid will not be evolved in the form of gas, but that some part of it will be retained in solution by the fluid in the generating bottle. Scheibler therefore directs that a correction of +0.8 measure is to be made to the volume of gas obtained. As the scale which Scheibler describes in his pamphlet is a scale of 25 measures, which is stated to be equal to 100 c.c., it is evident that the correction made is 3.2 c.c., and the evidence afforded by various parts of the pamphlet is overwhelming, that this is, in fact, the correction which he directs. Fresenius, however, states (fourth English edition, page 713) in his description of the process, "Scheibler has determined the small amount of carbonic acid which remains dissolved in the 10 c.c. hydrochloric acid at the mean temperature, and he directs to add 0.8 c.c. to the volume of the carbonic acid read off." This mistake of substituting 0.8 c.c. for 0.8 measure is again made by Mr. E. Nicholson (CHEMICAL NEWS, vol. xxix., p. 245), he says "Dr. Scheibler sets it down as 0.8 c.c. for 10 c.c. of acid, sp. gr. 1.12." Mr. Nicholson, however, goes on to say that he himself employs as a correction 1 c.c. when using only 5 c.c. of acid, and that this correction is a little too low; Mr. Nicholson's practice is thus not very far from Scheibler's actual direction.

Now this direction of Scheibler to employ a fixed correction for the quantity of carbonic acid retained by the fluid is, I believe, an entire mistake; the quantity thus retained being really proportional to the quantity of gas evolved, as can be shown both from theoretical considerations and by experiment.

The contents of the generating bottle are to be shaken

by rolling the liquid round the sides, so long as the column of water continues to fall in the measuring tube. Now supposing only a little carbonic acid has been evolved, the fluid is thus shaken with air containing very little of this gas, and the tension of the carbonic acid in the atmosphere being very small, the amount permanently retained by the fluid is small also. If, however, much carbonic acid has been set free, the atmosphere in the bottle is rich in this gas, its tension is much greater than in the former case, and the fluid retains a much larger quantity in solution. If, therefore, a fixed correction of 3.2 c.c. is employed in every experiment, the result will be much too high when a small quantity of carbonic acid is produced, and much too low when a large quantity has been evolved. It was, in fact, by trying the apparatus with large and small quantities of pure carbonates that I was led to perceive the error in question.

Scheibler is not altogether unconscious of the source of error involved in his fixed correction of +3.2 c.c., for he directs (p. 24) that the quantity of the sample taken should be such that the volume of gas set free should fall between 15 and 25 measures (60—100 c.c.), as with a smaller volume of gas the correction of 0.8 measure is no longer constant. This important statement, which greatly diminishes the value of the process, is omitted in Fresenius, who, after describing the process as of general application, merely says "the quantity [of bone-black] taken must be such that the amount of carbonic acid obtained may not be too small; about 3 grms. of the dried substance may be considered as the correct quantity." Nicholson also gives no hint of the limitation of his correction to certain volumes of gas. It is quite evident, however, that if what has been advanced is true, the corrections both of Scheibler and Nicholson can only be strictly accurate for *one volume* of gas, and cannot be extended with exactness to even a limited range.

The constant correction being shown to be erroneous, I next endeavoured, by means of test experiments with pure carbonates, to ascertain the true corrections for each volume of gas obtained. The first series of trials was made with pure anhydrous carbonate of sodium, and as it was intended in the experiments with tartar to remove the ash into the generating bottle by means of 5 c.c. of water, the carbonate of sodium was in this case also dissolved in 5 c.c. of water before being acted on by the hydrochloric acid. The total quantity of fluid in the generating bottle was thus 15 c.c., instead of the 10 c.c. supposed by Scheibler. The generating bottle was shaken in every case three minutes before reading. The results obtained were as follows. The carbonic acid is throughout expressed as cubic centimetres at 16°, and 760 m.m. pressure, saturated with water:—

Carbonate of Sodium taken (Gram).	Number of Experiments.	Carbonic Acid Evolved (Mean).	Carbonic Acid present in Carbonate of Sodium.*	Correction required in Experiment.	Correction at 7 per Cent.
0.05	1	10.67	11.30	0.63	0.75
0.10	5	21.25	22.61	1.36	1.49
0.15	1	31.58	33.91	2.33	2.21
0.20	5	42.28	45.22	2.94	2.96
0.25	1	52.52	56.52	4.00	3.68
0.30	5	63.32	67.82	4.50	4.43
0.35	2	73.58	79.13	5.55	5.15
0.40	5	84.30	90.43	6.13	5.90
0.45	2	95.02	101.74	6.72	6.65
0.50	6	105.71	113.04	7.33	7.40

* The volume of the carbonic acid in 1 grm. of carbonate of sodium at 16°, and 760 m.m., saturated with water, is here taken as 226.08 c.c., this being the relation of weight to volume in Scheibler's concluding tables, which I wished to make use of; my own calculation would make it 226.97 c.c.

The column showing the amount by which the measured gas fell short of the theoretical quantity present, proves at once that no fixed correction is possible

* I quote throughout from an edition dated 1871.

If we assume that with 15 c.c. of fluid in the bottle Scheibler's correction would be increased by one half, it will thus become 4.8 c.c., which will be the proper correction for some volume of gas between 60 and 70 c.c., but will be the proper correction for no other volume.

The last column in the table shows that we may assume with very little error that in the case of these experiments the correction needed is 7 per cent of the gas measured. Theoretically the correction should be a diminishing proportion with increasing quantities of gas, as the evolution of twice as much gas in one experiment as in another cannot quite double the tension of the carbonic acid in the generating bottle. It is quite possible, however, that other causes modify the result; thus the more carbonic acid is evolved, the more is the hydrochloric acid neutralised, and the liquid containing less hydrochloric acid in solution may be able to absorb more carbonic acid, and thus the diminishing increase of pressure may be counterbalanced by a corresponding rise in the solvent power of the liquid. The varying quantities of chloride of sodium present, and the heat of combination, may also affect the result.

The next series of experiments was made with Iceland spar powdered and dried; 10 c.c. of hydrochloric acid sp. gr. 1.12 were employed, and no water. The conditions were in these experiments precisely those supposed by Scheibler. Shaking was continued for two minutes in every case. The volumes of gas are reduced to the same pressure and temperature as before.

Carbonate of Calcium taken (Grm.).	Carbonic Acid Evolved.			Carbonic Acid present in Carbonate of Calcium.	Correction required in Experiment.	Percentage Correction.
	First Experiment.	Second Experiment.	Mean.			
0.05	11.28	11.14	11.21	11.98	0.77	6.9
0.10	22.50	22.48	22.49	23.96	1.47	6.5
0.20	45.20	45.02	45.11	47.93	2.82	6.3
0.30	67.87	67.89	67.88	71.89	4.01	5.9
0.40	90.91	90.71	90.81	95.86	5.05	5.6
0.50	113.60	113.23	113.42	119.82	6.40	5.6

Scheibler's correction of 3.2 c.c. is by this table the true correction when about 50 c.c. of gas are evolved, but in no other case. We have here a smaller percentage correction than in the previous series, the quantity of fluid in the generating bottle being less; the percentage correction also diminishes somewhat with the increase of the gas evolved, which we have already seen was theoretically to be expected. The results with Iceland spar were more accordant than those with carbonate of sodium.

Two further experiments were made with carbonate of calcium, 5 c.c. of water being added as in the previous experiments with sodium carbonate. 0.10 gm. of Iceland spar gave 22.22 c.c. of gas, reduced to 16°, and 760 m.m.; the correction required was therefore 1.74 c.c., or 7.83 per cent. With 0.40 gm. of spar, 89.19 c.c. of gas were obtained, requiring a correction of 6.67 c.c., or 7.47 per cent.

We now turn to the first part of Scheibler's pamphlet, in which he gives instructions for the determination of carbonate of calcium in bone charcoal. Here the volume of gas found is not corrected by the addition of 0.8 measure, but 1.7 grms. of charcoal having been taken for the determination, the percentage of carbonate of calcium is at once found by referring to Table I., in which to every measure of gas found is assigned its value in percentage of carbonate of calcium. The accuracy of this table can be easily examined by means of the test experiments with calcium carbonate just quoted; we have only to imagine that in each of these experiments 1.7 grms. of charcoal was taken, containing the quantities of carbonate of calcium actually operated on, and compare the percentage of carbonate of calcium present

on this assumption with the percentage deduced in Scheibler's table from the volume of the gas.

Carbonate of Calcium taken (Grm.).	Percentage if 1.7 Grms. Present.	Percentage by Scheibler's Table I.
0.05	2.94	2.71
0.10	5.88	5.64
0.20	11.76	11.28
0.30	17.65	16.86
0.40	23.53	22.49

It is clear from these figures that the percentages of carbonate of calcium deduced from Scheibler's Table I. are too low, and that the error is somewhat serious. I confess I do not understand how Table I. has been calculated, especially how in any part of the scale a measure of gas can have a smaller value than the amount of carbonic acid it contains; this is, however, actually the case in a part of Scheibler's table.

Scheibler's apparatus is one of great practical value, as very speedy results of fair accuracy can be obtained by its use. The mode of calculating the results described by Scheibler must, however, be abandoned, so far as the use of a fixed correction for the retention of gas in the fluid, and the employment of Table I. is concerned. By substituting a correction proportional to the volume of gas obtained, and reducing the volume of gas into terms of the carbonate sought by means of Scheibler's Tables III.—VI., the errors hitherto made will be avoided. I do not at all pretend that the proportional corrections here given as the result of my own experiments will be found to hold good at all temperatures, they are probably strictly true only for the temperature of the experiment.* A far more complete series of observations is required.

There are one or two points connected with the use of the apparatus which I will in conclusion briefly mention. Any rise of temperature during the experiment entails a notable error, as the final reading is increased by the expansion of the whole volume of gas in the apparatus. A small rise in temperature is sure to take place if the operator stands before the instrument for two or three minutes while shaking the generating bottle. This may be avoided by placing a narrow glazed screen between the instrument and the operator. The generating bottle should also be wrapped in paper during the agitation. Bone charcoal, and many other substances in which carbonic acid has to be determined, contain small quantities of sulphides; to prevent sulphuretted hydrogen being evolved a small quantity of mercuric chloride may be dissolved in the hydrochloric acid used.

ACTION OF CHLORINE ON PYROGALLOL.*

By JOHN STENHOUSE, LL.D., F.R.S., and CHAS. E. GROVES.

THE authors, after noticing the unsatisfactory results which they obtained by acting on pyrogallol in aqueous solution, proceed to describe the phenomena which take place when a current of chlorine is passed through a mixture of pyrogallol with twice its weight of glacial acetic acid.

At first, the liquid, which should be kept cool, assumes a dark, inky, purple colour, and occasionally deposits crystals of pyrogallol, thrown down by the hydrochloric acid produced in the reaction. As the action proceeds, however, these dissolve, and at last, when saturated with chlorine, the solution becomes of a pale orange red. If it be now heated to 70° C. for a short time, carbonic anhydride and hydrochloric acid are given off, and on cooling brilliant crystals of *mairogallol*† are deposited.

Mairogallol, $C_{18}H_7Cl_{11}O_{10}$, forms hard colourless six-sided prisms, which are insoluble in water, but very

* The temperatures during the test experiments varied from 15° to 18° C.

† Abstract of a Paper read before the Chemical Society.

‡ From $\mu\alpha\iota\rho\omega$, obs. to glitter.

soluble in ether and moderately so in boiling glacial acetic acid. It dissolves in hot concentrated nitric acid, and crystallises out again unchanged on cooling.

Leukogallol, $C_{18}H_6Cl_{12}O_{12} + 20H_2$, is prepared from pyrogallol by saturating the acetic acid mixture with chlorine in the cold in the manner above described; but, instead of heating the solution, about one-fourth of its bulk of concentrated hydrochloric acid is added. Carbonic anhydride and hydrochloric acid are evolved, and on standing the whole solidifies to a mass of minute crystals of the new substance. These are first partially purified by submitting them to strong pressure, to remove as much of the acetic acid as possible, and afterwards washing them with benzene. On dissolving the substance in the smallest quantity of dry ether, adding about one-third of its bulk of benzene, and then evaporating the ether in a current of dry air, crystalline crusts are deposited on the sides of the flask, which, when washed with a mixture of benzene and ether and re-crystallised two or three times, are ultimately obtained pure and colourless. This compound is readily soluble in water, but only moderately so in ether; nearly insoluble in benzene. When heated with nitric acid it is decomposed, with evolution of nitrous fumes and formation of chloropicrin, but no oxalic acid. At 104° it melts, but is at the same time decomposed, water and hydrochloric acid being given off and new products formed, one of which is readily soluble in hot benzene and crystallises out again on cooling in tufts of colourless needles. *Leukogallol* differs remarkably from *mairogallol*, by its great instability.

REPORT

ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

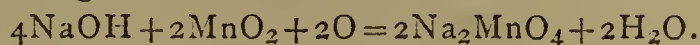
By Dr. A. W. HOFMANN.

(Continued from page 243).

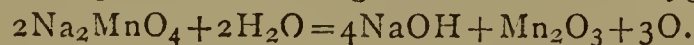
ATTENTION was directed to more sensitive transferrers of oxygen than baryta, and in the first place to chloride of copper. Its property, on exposure to the air to pass into oxychlorides of various composition, lies at the root of the manufacture of a well-known pigment, Brunswick green. In 1855, Vogel proposed the action of hydrochloric acid upon oxychlorides of copper as a source of chlorine.† Mallet‡ examined these bodies more closely, and in 1867 and 1868 proposed a method for the industrial preparation of chlorine and oxygen. He found that cuprous chloride is converted into oxychloride by a current of steam at from 100° to 200° C., which, in contact with hydrochloric acid, is immediately resolved into cupric chloride and free chlorine, but which, if heated to 400° , gives off all its oxygen. One kilo. of cuprous chloride yields 28 to 30 litres of oxygen. In experiments on the large scale, 100 kilos. of cuprous chloride yielded either 3 to $3\frac{1}{2}$ cubic metres of oxygen or 6 to 7 cubic metres of chlorine. As four or five such operations can be conducted daily, 200 to 300 kilos. of cuprous chloride could be made to yield daily 15 to 18 cubic metres of oxygen. The requisite apparatus consists of rotatory cast-iron retorts lined with clay, which contain the cuprous chloride mixed with one-third sand or kaolin to diminish its fusibility. This process was carried out in Cologne in 1871.‖ A company established at Paris for the utilisation of the process flourished for a short time only,§ probably because it was superseded by an analogous process.

We refer to the method which has been developed

since 1867* by the suggestive inventor, Tessié du Motay. Its transferrer of oxygen is the black oxide of manganese, and it is based upon the following reactions:—Hydrate of soda, according to Mitscherlich, if heated to dull redness in contact with air and black oxide of manganese, yields manganate of soda and water—



Manganate of soda at the same temperature in a current of dry superheated steam is resolved again into hydrate of soda, sesquioxide of manganese, and free oxygen—



The only condition, then, is to free the superheated air previously from carbonic acid, in order to obtain a mixture which shall be perpetually efficient. This method has been found satisfactory on repeated scrutiny, and has been applied on the large scale at Comines (near Lille), at Pantin (near Paris), at New York, Brussels, and Vienna. Bothe† reports that a melting of 60 parts of dry carbonate of soda with 40 parts of peroxide of manganese at 95 per cent yielded, according to analysis 74.62 of manganate of soda, and that 40 kilos. of this substance, which, according to theory, should yield 2036 cubic decimetres of oxygen, actually produced 1800, or 90 per cent of the calculated yield. He recommended the process as easy of execution. The most complete description has been given by Pourcel‡. According to him, Tessié du Motay employs for retorts cast-iron ellipsoids, which lie horizontally side by side and are divided by a grate into two unequal portions parallel with their axis. Upon the grate are spread in each retort 350 kilos. of manganate of soda, or the corresponding reduced mixture of soda and manganese, in such a manner that its thickness amounts to 0.6 of a metre, and the empty space above and below the mass is as small as possible. In Comines, where five such retorts are in action, the daily production amounted to 140 cubic metres of oxygen, with an expenditure of 450 kilos. of coal for heating the retorts and 150 kilos. for the steam-engine.

(To be continued.)

ON A NEW WAY OF OBSERVING ABSORPTION SPECTRA.

By Dr. T. L. PHIPSON.

I THOUGHT it would be interesting to ascertain what effect upon the absorption spectrum of any given substance would be obtained if this spectrum was viewed through a thin layer of the substance itself. I therefore disposed my spectroscope with the double slit, so that one slit gave the spectrum of the substance to be examined and the other that of the solar light, and both these spectra were viewed at the same time through a thin layer of the substance to be examined. In this way I found that the slit giving the spectrum of the solar light only, was now producing the absorption bands of the substance placed before the prism, and that the absorption bands in the other spectrum were augmented in intensity as if a much thicker column of fluid had been used to produce its spectrum. It is therefore quite possible to study the absorption bands in the spectrum of a liquid when the latter is placed in a thin layer between the eye and the prism, the slit of the spectroscope receiving only ordinary daylight; and the action of a thin layer of the substance yielding the spectrum upon the latter, when this thin layer is placed before the prism, consists in increasing its intensity, just as if the thin layer had been placed between the substance examined and the slit of the instrument. The experiments were made with dilute solution of acid permanganate of potash.

* "Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends."

† Vogel, *Wagner, Fahr. sberichte*, 1861, 177.

‡ Mallet, *Comptes Rendus*, lxiv., 286, and lxvi., 349.

§ Phillips, "Der Sauerstoff" (Berlin, 1871), 22.

§ Wagner, *Jahresberichte*, 1867, 215.

* Tessié du Motay, *Institut*, 1868, 48.

† Bothe, *Zeitschr. d. Vereins Deutsch. Ing.*, 1867, 334.

‡ Pourcel, "Mémoires de la Société des Ingénieurs Civils," P 1873.

This action of a thin layer of any substance upon its own spectrum may prove useful in many cases, either to verify this spectrum, or to increase its intensity, &c.

Laboratory of Analytical Chemistry,
Putney, S.W.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, June 3, 1875.

Professor ABEL, F.R.S., President, in the Chair.

AFTER the minutes of the previous meeting had been read and confirmed, and the donations announced, Messrs. P. Melmore, R. E. H. Goffin, C. G. Cresswell, and A. Senier, were formally admitted Fellows of the Society. The names read for the first time were those of Messrs. A. W. Gerrard, J. Brett Guyer, E. Gee, and A. N. Gow, Messrs. Falkland Mackinnon, Charles Thomas Blanshard, B.A., George Crampton, John Cope Butterfield, Joseph Wilson Iwan, Alexander Wynter Blyth, Robert Stetton, Thomas Purdie, jun., and the Rev. W. J. J. Welch, M.A., were elected Fellows of the Society after their names had been read the third time.

The first paper, by Mr. J. T. COLEMAN, was on "*The Effects of Pressure and Cold upon the Gaseous Products of the Distillation of Carbonaceous Shales.*" The author finds that if the gas which is produced in such large quantities in the preparation of oils by the distillation of shales is submitted to a temperature of 0°F. , at a pressure of 140 lbs. to the square inch, a quantity of volatile hydrocarbons having a density of about 0.680 is obtained suitable to be used for air-gas purposes, or for increasing the illuminating power of poor coal gas. The amount of liquid condensed is about one gallon per 1000 cubic feet of gas. The latter, after the removal of these hydrocarbons, burns with a blue flame resembling that of a Bunsen's burner.

The PRESIDENT having thanked the author for this interesting communication, a paper by Dr. C. BROWN "*On the Agricultural Chemistry of the Tea Plantations of India,*" was read. This paper contains a large number of analytical results connected with the cultivation of the three varieties of the tea plant grown in India. In one instance it was found that in the portion of the tea garden treated with Dr. C. Brown's fertiliser, the yield of tea per acre was 494 lbs., and in the unmanured portion it was only 397 lbs. Analysis of the ash of the two specimens of tea yielded results which were almost identical.

The PRESIDENT, in thanking Dr. Brown for his important contribution to the agriculture of the tea plant, said it would scarcely be possible to do justice to it without studying it in detail.

Mr. WAY was much struck by the interesting fact which the table of the ash constituents showed, that there was a large amount of soda uncombined with chlorine. In his own somewhat extended experience he had observed that the sodium, in most cases, was chiefly present as sodium chloride.

Mr. WARINGTON remarked that the diminution in potash and phosphoric acid, and the increase in lime, which Dr. Brown found in the old leaves as compared with the young buds, also occurred in the older leaves of forest trees. It had been suggested that the proportion of potash to lime in the ash of tea would determine whether it were made from young or old leaves, but by adulteration, old tea leaves with the buds of other plants, the natural proportion of lime and potash would be destroyed. Dr. Brown had apparently selected a manure for the tea plant from considerations based on the composition of the ash. The composition of a plant was a very unsafe guide to the selection of an economical

manure. Thus the turnip was rich in potash and poor in phosphoric acid, yet the latter substance was by much the more efficient manure. Clover, again, was a highly nitrogenous crop, while wheat contained far less nitrogen; yet nitrogenous manures had scarcely any effect on clover, but greatly increased the growth of wheat. The fact was that plants assimilated different portions of their food with different facility, and required most aid from manure in respect of those ingredients which they had most difficulty in acquiring. Actual experiment with a series of manures was the only means of ascertaining the most economical manure for a given crop and soil.

Dr. THUDICHUM remarked that the table suggested a very interesting point. We knew that potash was very necessary for plant growth, and it was remarkable that as the leaf grows old it loses its potash. It would appear from this that after the potash had served to build up the leaf, as it were, it was absorbed again into the system, its place being taken by lime and magnesia. In certain pathological diseases the potash in the cell structure is withdrawn and replaced by lime. It would seem, therefore, and this was a point of great importance, that potash was essential both to animal and to vegetable life.

He did not quite agree with the last speaker as to the effect of manures. In the case referred to it was not the phosphoric acid, but the sulphuric acid which was accidentally present, that gave the manure its peculiar action.

Professor MASKELYNE then gave a short account of Mr. J. A. Phillips's paper "*On the Structure and Composition of Certain Pseudomorphic Crystals having the form of Orthoclase.*" These remarkable crystals, which occur at Huel Coates, in Cornwall, are felspar crystals in which the potash has been removed and its place occupied by oxide of tin and other minerals. The author has procured thin sections of these crystals and submitted them to microscopical examination. He describes their appearance as that of a mass of interlaced mica-like plates of a silvery white colour interspersed with quartz crystals and crystals of tin oxide, and in some instances blue tourmaline (indicolite). The paper contains analyses of two specimens of these pseudomorphs of very different composition.

The PRESIDENT said the Fellows were much indebted to the author and also to Professor Maskelyne for the lucid comments which he had combined with the summary of the paper.

Dr. WRIGHT then read two papers by himself, and Mr. G. H. BECKETT, the first of which was entitled "*Notes on the Sulphates of Narceine and other Narceine Derivatives.*"

After referring to the pertinacity with which narceine hydrochloride retains traces of hydrochloric acid, and the readiness with which the former is decomposed by water, the authors say that in no case could they get any definite narceine sulphate more basic than the "bisulphate," which is prepared by crystallising narceine from dilute sulphuric acid two or three times. It has the composition $\text{C}_{23}\text{H}_{29}\text{NO}_9 \cdot \text{H}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$, but breaks up in presence of water into more basic salts of indefinite composition. Unlike the hydrochloride, narceine sulphate is *completely* decomposed by sodium carbonate, affording a means of obtaining pure narceine. The action of nascent hydrogen on narceine removes the oxygen and gives rise to an uncrystallisable base. When narceine is heated with acetic anhydride it is partly dehydrated, and with excess of ethyl iodide it yields a varnish like non-crystalline compound $\text{C}_{23}\text{H}_{29}\text{NO}_9 \cdot \text{C}_2\text{H}_5\text{I}$.

In the second paper "*On the Action of Organic Acids and their Anhydrides on the Natural Alkaloids. Part V.,*" the authors treat of the action of succinic acid, camphoric acid, and oxalic acid, on codeine and on morphine, and of tartaric acid on codeine. With succinic acid the action is not similar to that which takes place with the mono-

basic acids, but a new class of compounds is formed analogous to the ethylene-succinic acid of Lourenço. The action of oxalic acid on the alkaloids converts them into a mixture of polymerides from which, in one case, dicodeine and tricodeine were isolated, and in the other dimorphine, trimorphine, and tetramorphine.

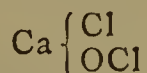
The PRESIDENT thanked the authors, in the name of the Fellows, for their valuable papers. After which a communication, entitled "*Action of Chlorine on Pyrogallol*," by Dr. J. STENHOUSE and Mr. C. E. GROVES, was read by the latter. An abstract of this appears in another part of our Journal. At its conclusion Mr. LEWIS gave an account of three forms in which mairougallol crystallises.

The PRESIDENT having thanked the authors for their interesting communication, Mr. W. H. Perkin read a paper "*On Nitro-alizarin*." He finds that the action of nitric acid on diacetyl-alizarin produces nitro-alizarin $C_{14}H_7(NO_2)O_4$, a very definite and stable body crystallising in orange yellow needles, and dissolving in caustic alkalis with a beautiful blue colour. Reducing agents convert this into amido-alizarin $C_{14}H_7(H_2N)O_4$, which crystallises from alcohol in dark chocolate coloured needles with a greenish metallic lustre. The solutions of this substance are crimson red, and its alkaline derivatives are of a similar colour.

Nitro-alizarin produces with alumina mordants an orange red colour similar to "aurin," and with iron mordants a reddish purple, whilst amido-alizarin gives a purple with alumina mordants, and a bluish violet or steel colour with iron. Both these derivatives dye unmordanted silk; nitro-alizarin a clear golden colour, and amido-alizarin a purple red. The author also gave an account of monacetyl-alizarin $C_{14}H_7(C_2H_3O)O_4$. It crystallises in golden scales, and like the diacetyl derivative, is readily decomposed by alkalis.

The PRESIDENT thanked the author in the name of the Fellows for his valuable and interesting paper, and Mr. R. Williamson then read a communication "*On some Metallic Derivatives of Coumarin*." After noticing the silver compound $C_9H_6O_2, Ag_2O$ obtained by Mr. Perkin, the author proceeded to give a description of the various derivatives he had obtained. The sodium compound $C_9H_6O_2, 2NaHO$ forms a yellow gummy product which does not crystallise. When heated to $150^\circ C$. it loses water, and then no longer yields coumarin when treated with an acid, but an amorphous brown substance. The potassium compound $C_9H_6O_2, 2KHO$ is very similar. The barium compound is not crystallisable. All these are prepared directly from coumarin and an aqueous solution of the base. The lead compound, $C_9H_6O_2, 2PbO$, is obtained as a bright yellow precipitate on adding plumbic nitrate or acetate to a solution of the sodium compound.

The last paper was on "*The Action of Dilute Mineral Acids on Bleaching Powder*," by Mr. F. Kopfer. The author, after noticing the conflicting statements as to the nature of this important compound, gives details of the experiments he made by carefully distilling an aqueous solution of carefully prepared chloride of lime with various acids (acetic, hydrochloric, and nitric) in the proportion sufficient to liberate only the hypochlorous acid, assuming the formula—



proposed by Dr. Odling to be the correct one. In all cases he found that pure hypochlorous acid was obtained free from chlorine. It would seem therefore that the view of the constitution of this compound originally proposed by Gay-Lussac, or that of Odling, is the correct one.

The next meeting, the last of the session, will take place on Thursday, June 17, when the following papers will be read:—

(1) "*On Nitrosyl Bromide and on Sulphur Bromide*," by Mr. M. M. P. Muir; (2) "*Notes on the Chemistry of*

Tartaric and Citric Acid," by Mr. R. Warington; (3) "*On the Action of Nitric Acid on Copper, Mercury, &c., Especially in the Presence of Metallic Nitrates*," by Mr. J. J. Ackworth; (4) "*Decomposition of Water by the Joint Action of Aluminium and Aluminium Iodide, Bromide, or Chloride: Including Instances of Reverse Action*," by Dr. Gladstone and Mr. A. Tribe; (5) "*On Achrematite: A New Molybdo-Arsenate of lead*;" (6) "*New Reactions of Tungsten*," by Professor Mallet; (7) "*On the Action of Chlorine on Acetamide*," by Mr. E. W. Prevost.

PROCEEDINGS OF THE

SOCIETY OF PUBLIC ANALYSTS.

AFTER the reading of the papers by Dr. Tripe, Mr. Heisch, and Mr. Angell, "*On the Methods of Taking the Melting-Point of Fats*," at the meeting held May 5th (see p. 228), the following discussion ensued:—

Dr. REDWOOD described a method which he had adopted. He had had some experience, and found great difficulty in determining with certainty the melting-point of fats, such as tallow, &c. The tubes to which Mr. Heisch had referred were extremely similar to those mentioned by Mr. Duffy many years ago. That gentleman found that fats such as tallow and stearine had two different melting-points, according to the difference of the treatment to which they had previously been subjected; for instance, the same sample of tallow after being clarified and freed from water will give two melting-points varying by $20^\circ F$., the variation depending upon whether it had been previously melted at a temperature considerably above its melting-point or at exactly its melting-point. The ordinary clarified tallow of commerce, melted at a very high temperature, shows a melting-point of 95° or $96^\circ F$. If carefully re-melted at that temperature, and then cooled, and the melting-point again taken, it will then be found to be 115° or $116^\circ F$., being about 20° higher. The capillary tube used by Mr. Duffy and Mr. Heisch is better adapted to give accurate results than the floats, because of the smaller quantity of fat acted upon. He (Dr. Redwood) was also in the habit of using a test-tube $\frac{1}{2}$ or $\frac{3}{4}$ of an inch in diameter, containing mercury, with a thermometer immersed in it. A small portion of the melted fat—say 1 grain—is dropped upon the surface of the mercury. The tube is immersed in a water-bath, the water being above the level of the mercury. The temperature of the mercury will be alike throughout, and the melting-point will be shown by the drop of fat becoming transparent and flowing over the surface of the mercury. This is an easy and reliable method of working upon tallow. Numerous experiments made, on determining the solidifying point of fats, have demonstrated the great difficulty of obtaining uniform results.

Dr. STEVENSON pointed out that although there was no difficulty in getting accordant results from the same sample of butter, by experimenting in different ways, yet when different samples were taken, the genuineness of which was assured, the results were sometimes anomalous, and this may not be surprising bearing in mind the difference existing between certain fats. The substance called "butterine" gives a higher melting-point than genuine butter.

Mr. WANKLYN remarked that the thickness of the glass tubes used might seriously affect the indications of temperature, owing to the low conducting power of glass.

Dr. DUPRÉ expressed his decided preference for the capillary tube. He, however, considered it essential that the samples of fat should be subjected for an hour or so to a uniform temperature before commencing the experiment. It was also important that the beaker in which the tubes of fat are to be placed should be itself put into a larger

beaker, also containing water, and that the temperature should not rise more rapidly than one degree in ten minutes.

At the meeting on June 1st Mr. WIGNER read a paper on—

THE PROBABLE WORKING OF THE NEW ACT AS COMPARED WITH THE OLD.

As this is probably the last opportunity which we, as a Society, shall have of discussing the Sale of Food and Drugs Bill before it becomes Law, it seems desirable that we should consider what differences there are between the Bill in its present state and the old Adulteration Act, and then consider the objectionable provisions which still remain in the Bill.

It will be in your recollection that there are two Adulteration Acts (those of 1860 and 1872) still in force, the latter one incorporating the former. We may therefore proceed with the comparison between the 1872 Act and the "Sale of Food and Drugs Bill, 1875."

The preamble of the "Adulteration of Food Act, 1872," recites that "the practice of adulterating articles of food and drink for sale in fraud of Her Majesty's subjects, and to the great hurt of their health and danger to their lives, requires to be repressed." And the preamble of the Act of 1860 was almost identical. The Bill now before us contents itself with stating that "it is desirable that the Acts now in force relating to the adulteration of food should be repealed, and that the law regarding the sale of food and drugs in a pure and genuine condition should be amended." It will thus be seen that the older Acts took for their basis the act of fraud, which is ignored in the preamble of the 1875 Bill.

The Act of 1872, whilst providing for the punishment of persons found guilty of adulterating articles of food and drink, omitted to give any definition of what constituted "adulteration" or what was to be understood by "any article of food or drink." It therefore remained for the Courts to decide what adulteration was, and they virtually—if not actually—construed it to be "impurity." In the 1875 Bill, not only is there no definition of "adulteration," or of an adulterated article, but the very word adulteration is carefully eschewed. The term "food" is, however, defined as "every article used for food or drink by man other than drugs or water, and is perhaps as clear and comprehensive a definition as could be desired. It should be carefully noted that under this Act no Public Analyst can be called upon to make any water analyses, and this is, so far, a gain, as under the old Act some authorities held that water was included. Leaving out of consideration the clauses in both Bills where a *knowledge* of adulteration on the part of the manufacturer or vendor has to be proved, we may compare the acting clauses of the two bills.

The first clause of the 1872 Act makes it an offence to sell an article adulterated with "any injurious or poisonous ingredient." The suggestion made by us has been adopted, and the new Bill says with any "ingredient or material so as to render the article injurious to health." The improvement is obvious.

The second clause in the old Act makes it punishable for any person to sell "as unadulterated any article of food or drink, or any drug which is adulterated."

Clause 5 in the new Bill enacts that "No person shall sell to the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, and quality of the article demanded." This clause is qualified by certain "exceptions," which have undergone most remarkable changes as the Bill has passed through Committee; but though it would be easy to quibble as to some of them, even in their present state, yet on the whole—looked at in a common-sense way—I think they are not open to objection. Remembering that the old Act contained no definition of adulteration, but only said that an

adulterated article should not be sold, I submit that the new Act holds out but little hope of amelioration for persons selling adulterated or spurious articles.

The old Act contained no comprehensive provision as to drugs, but referred us to two previous Acts, and enacted in addition that no drug should be knowingly mixed with "any substance with intent fraudulently to increase its weight or bulk." In clauses 4 and 6 of the 1875 Bill very comprehensive regulations are laid down; thus—

4. No person shall, except for the purpose of compounding as hereinafter described, mix, colour, stain, or powder, or order or permit any other person to mix, colour, stain, or powder, any drug with any ingredient or material so as to affect injuriously the quality or potency of such drug, with intent that the same may be sold in that state, and no person shall knowingly sell any such drug so mixed, coloured, stained, or powdered, under the same penalty in each case respectively as in the preceding section for a first and subsequent offence.

6. No person shall sell any compounded drugs except the same shall be compounded in accordance with the demand of the purchaser, or with the prescription in writing of a registered medical practitioner, or with the regulations prescribed by the British Pharmacopœia issued by the General Medical Council, or in Great Britain with a basis to be laid down by the Council of Pharmaceutical Society of Great Britain, or the Privy Council, or in accordance with the provisions of the Pharmacy Act, 1868, or in Ireland in accordance with the Act of the session of the thirty-third and thirty-fourth of Victoria, chapter twenty-six, under a penalty of twenty pounds.

The importance of the words "so as to affect injuriously the quality or potency of such drug" is self-evident.

Clause 6 also makes an important provision as to compound articles of food. It says:—

6. No person shall sell any compound article of food which is not composed of ingredients in accordance with the demand of the purchaser, under a penalty of twenty pounds.

This is perhaps somewhat obscure; but if I understand it aright it would ensure a purchaser getting what he wanted, even if he did not require an unmixed article: thus if a man (as many people do) wanted a mixture of coffee and chicory, it would be compulsory on the vendor to supply coffee mixed with *chicory*, and not with some other adulterant, as, for instance, roasted acorns.

Clause 3 in the old Act says that, in the case of "mixed" articles the admixture shall be "declared," but it does not say *how*. The Courts have repeatedly held that verbal declaration was the only declaration contemplated by this clause, and there have been numerous convictions for selling mixtures of coffee and chicory even when they have been so labelled.

Clause 7 in the new Bill enacts that in cases of "mixtures" the article shall be accompanied by a "label distinctly and legibly written or printed," declaring the admixture.

The Act of 1872 contains no provision forbidding the abstraction of any important constituent of an article of food, and although in several districts the magistrates have convicted in cases of "skim" milk, the convictions have, I consider, been obtained by straining the Act of Parliament. This omission is supplied by clause 8 of the Bill of the present year, where it is provided—

8. No person shall, with the intent that the same may be sold in its altered state without notice, abstract from an article of food any part of it so as to affect injuriously its quality, substance, or nature, and no person shall sell any article so altered without making disclosure of the alteration, under a penalty in each case of twenty pounds.

Clause 9 in the old Bill and clause 11 in the new relate to the analysis of articles of food brought by purchasers other than duly appointed inspectors; and in this case the old Act is the best, inasmuch as under it such purchasers had to take their samples to the inspectors, whereas under

the new Bill they are to take them direct to the Analysts. This I consider very objectionable; and as the inconvenience and undesirability of such a system has been repeatedly pointed out, and as no reason for its enactment has been given, I am at a loss to know on what ground our legislators have insisted upon its retention.

Clause 5 in the old and clause 9 in the new Bill relate to the appointment of Analysts, and they are practically identical, except that in *future* no person engaged in any trade connected with the sale of food or drugs shall be eligible for the appointment of Public Analysts for the place where such business is carried on. This will, however, of course not interfere with any appointments already made.

Clause 6 in the old Act and clause 12 in the new relate to the purchase of samples by inspectors duly appointed, but though the intention of the framers of the two measures may have been substantially the same, the wording is different. The first says—

"The Inspector, &c., . . . shall procure and submit samples of articles of food or drink and drugs suspected to be adulterated to be analysed by the Analysts, &c."

The second reads—

12. Any medical officer of health, inspector of nuisances, or inspector of weights and measures, or any inspector of a market, or any police constable under the direction and at the cost of the local authority appointing such officer, inspector, or constable, may procure any sample of food or drugs, and if he suspect the same to have been sold to him contrary to any provision of this Act, shall submit the same to be analysed by the Analyst of the district or place for which he acts, and such Analyst shall with all convenient speed analyse the same and give a certificate to such officer, wherein he shall specify the result of the analysis.

Now it will be seen that a strict interpretation of the clause last read might lead to consequences amounting to the ludicrous; as an inspector after having, in pursuance of his instructions, purchased certain samples is only bound to take them to the Analyst if he suspects them to be adulterated. An unsuspicious inspector might therefore (feeling quite satisfied of the quality of the goods he had bought) decide not to trouble the Analyst with them, but take them home for his household consumption instead. Absurd as this is it is really, I imagine, of little moment, as it may safely be left to the local authorities to give explicit instructions to their inspectors that when articles are bought with public money for the purpose of analysis they *shall* be analysed.

Clause 12 also provides that Medical Officers of Health and policemen may be appointed as inspectors. The former certainly seems a useful addition.

One of the most important points in the Act is that relating to sealing and dividing, and the rule laid down in the new Bill is very objectionable. Up to now (as everybody knows) the inspector has taken the whole of the sample to the Analyst, where it has been divided into two parts, the inspector retaining one which the Analyst has duly secured and sealed: but in clause 13 of the new Bill the inspector is to divide the sample *on purchasing it* into three parts, hand one part back to the vendor, keep one himself, and take the third one only to the Analyst. It will be at once seen that if there were any collusion between the vendor and the inspector, or, for that matter, between the vendor and a private purchaser, the Analyst might be placed in a very awkward predicament. Thus, the purchaser goes to the shop of a friend of his, and seals up three packets. Two of them are pure coffee, and the other contains 50 per cent of chicory. Of the two pure ones, he takes one home with him, and hands the other back to the vendor. The adulterated one he then takes to the Analyst, who of course certifies to the adulteration. The vendor disputes the analysis; a second analysis is ordered of the purchaser's, or the vendor's portion, or of both. The coffee is found to be pure, and the Analyst is stigmatised as "incompetent." There is not much objection to the proposal to leave one portion with the vendor,

but the remainder should certainly be brought as now to the Analyst and divided by him, so that at least one authenticated duplicate sample should still remain. The Government have had the matter repeatedly pointed out to them both in and out of the House, and their only objection to such an obviously just proposal is that it does not fit in with the clause authorising transmission of samples by post. In the new Bill no provision is made for allowing a vendor to accompany a purchaser to the Analyst.

We may summarise the remaining new points in the Bill before us.

Clause 16 provides a penalty in the case of a vendor refusing to supply an inspector.

Clause 18 orders that all local authorities shall make an annual report to the Local Government Board, giving particulars of the working of the Act in their districts.

Clause 20 gives the right to a defendant to tender himself or his wife as witnesses for the defence.

Clause 21 is the much-canvassed Somerset House clause, and is entirely objectionable, though it appears to be inevitable. I may just point out three things in it.

(1.) It says the justices "may" send samples to be analysed there, not that they *shall*.

(2.) Nothing is said *pro* or *con* as to the Analyst being required to attend and give evidence; and in the absence of this it is as probable as not that the magistrate would *not* enforce attendance.

(3.) No form of certificate is prescribed for the Inland Revenue chemists to use, though a form for the Public Analysts is carefully drawn out.

Clause 24 meets a just complaint on the part of the tradesman by allowing him to go free on the production of a warranty from the wholesale dealer, and clause 26 makes the forgery of such a warranty penal.

Clause 25 provides for the fines in every case going to the local authorities, to be applied towards the expenses of the Act.

In the discussion which followed the reading of this paper no difference of opinion was expressed as to the conclusions at which Mr. Wigner had arrived.

Dr. BERNAYS, after stating his opinion as to the value of the paper, and to the obligation which the Society owed to Mr. Wigner for his exertions in reference to the sale of Food and Drugs Bill, related a case in his experience corroborative of the fact that samples are sometimes tampered with.

Dr. DUPRÉ particularly objected to Clause 11, on the ground that it allowed a purchaser to bring samples direct to the Analyst, and to claim a certificate addressed to him personally, which might afterwards be used as a trade advertisement. He also insisted very strongly on the very objectionable provisions in clause 13 as to sealing and dividing samples, and to illustrate the danger to which Analysts will be exposed if it remains unaltered, referred to a beer case in which he was concerned recently, and particulars of which were published in CHEMICAL NEWS, vol. xxxi., p. 235. The speaker next adverted to clause 21, and pointed out the injustice of taking the mere *ipse dixit* of an official at Somerset House as against the duly authenticated certificate of a Public Analyst of repute; and he argued that, unless the Inland Revenue *employés* were compelled to attend the adjourned hearing of disputed cases and verify their results on oath, it would be impossible for Public Analysts to retain their appointments with due regard to their self-respect. Dr. Dupré added—I will not say anything against the chemists of Somerset House, because I know very little of them. I may say that I know of no improvement in analysis which could be traced home to Somerset House; whereas we know that there are a number of Public Analysts appointed who have been before the public for years, and who have themselves discovered processes by means of which the public can judge them. It seems to me entirely inadmissible that such men should be put below

the level of the officials at Somerset House. All their work is done, of course, officially, and, as far as I am aware, it never comes fairly before the public. Now I should be sorry if it were understood that I object to have my analyses checked at all; on the contrary, I think the check is exceedingly useful. It keeps us all up to the mark; but, whoever has to check my analysis, must do as I have to do. That is to say, if I require it, he ought to appear in court, and ought to tell me "I found such and such a thing, and I found it in such and such a manner." (Hear, hear.) If that is done, I do not care whoever checks my analysis.

Mr. ALLEN (Sheffield) gave additional instances of the improper substitution of samples.

Dr. TRIPE said—I merely desire to express my approbation of what has been said in this matter. I feel very strongly that, if the Bill should pass as it now is, we should be in the hands completely of any unscrupulous man of whom purchases of food may be made. And, indeed, if we consider that, when a man is unscrupulous enough to adulterate food, and to sell as pure an article which is not pure, I think it is not drawing the string too tightly to suppose that he may carry the matter a little bit further, and do as has been done in many cases, substitute one article for another.

Mr. ANGELL (Southampton) next addressed the meeting, dealing chiefly with the clause in the Bill as to the forwarding samples by post.

Mr. HORSLEY (Cheltenham), who announced himself as "the first county Analyst ever appointed," speaking on the same clause, described the plan he adopted for the reception of samples by means of the police force.

The CHAIRMAN—I should wish to remark how very complete the proof is that Dr. Dupré's two samples, which were legally identical, were not identical in fact. Here are two samples legally identical. These samples yield respectively 40 of chlorine and 136. This determination was made with the same solution of silver. Now, we all of us are in the habit of making these determinations of chlorine with silver solution, and we know that it is quite impossible, if the samples are identical, to return the one as 40 and the other as 136. The two same samples were examined for alcohol, and found different. It is very fortunate that the case was capable of being dealt with in so complete a manner, and it is fortunate that a chemist who stands so high as Dr. Dupré had these samples before him, and that we are able to point to a case in which we can say absolutely that the legal precautions which had been taken to procure identity of sample are not sufficient. As to Somerset House, Mr. Sclater-Booth explained to Dr. Redwood and myself, when we waited upon him, that one of the chief reasons, if not the very reason, why the Government proposed this reference to Somerset House was, that it was very economical and it would cost comparatively nothing.

Dr. DUPRÉ—If it is so very economical, we shall have many cases referred.

In reply, Mr. WIGNER said that Mr. Clare Read told him distinctly that Mr. Sclater-Booth's intention was that the chemists of the Inland Revenue should come into court. Mr. Sclater-Booth confirmed that in his hearing, when speaking in Committee, and a Somerset House official, in a letter which was put into his hands, also confirmed it. But still it is perfectly clear that the Act does not enforce it, and therefore he thought that we ought to have some resolution this afternoon instructing us to get inserted in the act some words which will carry that out.

THE SALE OF FOOD AND DRUGS BILL.

THE Sale of Food and Drugs Bill passed its second reading in the House of Lords on the 7th inst., on the motion of the Duke of Richmond. In the discussion, Lord Redesdale pointed out that Clause 7 (relating to mixed articles, should provide that the label declaring an article to be mixed should also state what substance it is mixed with and the proportion of the foreign ingredient.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 18, May 10, 1875.

Presence of Anhydrous Sulphuric Acid in the Gaseous Products of the Combustion of Iron Pyrites.

—A. Scheurer Kestner.—The white fumes which accompany the sulphurous acid produced by the combustion of pyrites have been ascribed to sulphuric acid, due to the concurrence of the sulphurous acid and of the moisture contained in the pyrites. But these vapours are formed with equal facility from dry pyrites, and on examination we find that they are condensed with difficulty, and that they are chiefly composed of anhydrous sulphuric acid, to the formation of which moisture or water can have contributed nothing. The sulphurous acid produced by the combustion of sulphide of iron in pyrites-kilns is in prolonged contact with very hot walls of masonry, or of pyrites completely or imperfectly burnt. Hence it follows that anhydrous sulphuric acid can only be formed by the decomposition of the sulphurous acid itself, or by its oxidation, the two phenomena being occasioned by the great heat to which the gases are exposed. Direct experiment proves that sulphurous acid is not decomposed, even at a temperature higher than that of pyrites-kilns. Its aqueous solution is easily decomposed; if heated to 200° in a sealed tube, into sulphuric acid, and a deposit of free sulphur, but the gaseous acid resists heat. The presence of anhydrous sulphurous acid must therefore be ascribed to the oxidation of sulphurous acid. The sulphurous gas in pyrites-kilns being mixed with large quantities of air, we are naturally led to suppose that the elevated temperature favours the combination of atmospheric oxygen with sulphurous acid. To determine this point, the author passed sulphurous acid, mixed with double its volume of air, through a platinum tube of 40 centimetres in length, and heated to redness. The gases before entering the tube traverse a solution of chloride of barium to serve as a proof of the absence of sulphuric acid before their passage through the tube. A solution of chloride of barium, which the gases traversed after issuing from the tube remained perfectly clear. No white vapour was perceived; consequently there was no trace of the formation of anhydrous sulphuric acid. To explain the oxidation of the sulphurous acid there remains merely the intervention of the oxygen of the ferric oxide already formed by the combustion of the sulphur of the pyrites. Further experiments proved, in fact, that the sulphurous acid is oxidised at the expense of the oxygen of the ferric oxide. This is a new instance of the remarkable oxidising powers of ferric oxide which serves to transfer oxygen from the atmosphere to the oxidisable body.* The presence of sulphuric acid in the gases derived from the combustion of pyrites explains, to a certain extent, the default of oxygen which has been observed in these gases at the moment when they are directed into the leaden chambers for the manufacture of sulphuric acid. When these gases are analysed we never find a quantity of oxygen sufficient to represent, with the sulphurous acid which they contain, and the oxygen combined with the iron of the pyrites, all the oxygen of the air which has served to support the combustion of the sulphide of iron. The following is a comparison between the composition of the gas of a pyrites-kiln as found, and as calculated on the basis of 4·34 per cent of sulphurous acid:—

	Found.	Calculated.
Sulphurous acid	4·34	4·34
Oxygen	11·18	15·41
Nitrogen	84·48	80·25

* *Comptes Rendus*, xlix., pp. 257, 428, and 968.

Moniteur Scientifique, du Dr. Quesneville,
April, 1875.

On Eosin.—A. W. Hofmann.—From the *Berichte der Deutschen Chem. Gessellschaft*.

On Mesidin.—A. W. Hofmann.—From the same source.

Chemical Constitution of Chloride of Lime.—W. Wolters.—A long dissertation, incapable of useful abstraction.

Use of the Oils of Coal in the Preparation of the Alkaloids.—MM. G. Boiraux and E. Léger.—The author's have been engaged with experiments on the use of certain oils of coal as substitutes for alcohol in the preparation of the alkaloids. They have investigated, for this purpose, benzols boiling from 50° to 100°; common benzol boiling from 80° to 120°, and a mixture of the foregoing with 5 per cent of phenic acid. They remark that vegetable matters to be treated with benzol must previously be dried with the utmost care.

Action of Organic Acids upon the Natural Alkaloids.—G. H. Beckett and R. Alder Wright.—From the English.

Chemical Products at the Exhibition of Vienna.—M. E. Kopp.—An account of the fatty bodies, and the products of destructive distillation.

Analysis of Ores of Nickel and Cobalt.—R. Fresenius.—From the *Zeitschrift für Analytische Chemie*.

Varieties in Analytical Chemistry.—A collection of paragraphs taken from the *Zeitschrift für Analytische Chemie*, the *CHEMICAL NEWS*, and the *Berichte der Deutschen Chemischen Gessellschaft*.

Researches on the Combination of Grape-Sugar with Copper, and on Frommherz's Assay.—E. Sal-kowski states that, if in testing diabetic urine the sulphate of copper is added without precaution, the precipitate formed does not re-dissolve, and the filtrate is colourless, feebly alkaline, containing neither copper nor sugar, or at most a trace of sugar. The bulk of the sugar is in the precipitate, and is held with such force that it cannot be withdrawn by prolonged washings. If we mix 1 atom of sugar, 5 atoms of sulphate of copper, and 10 atoms of hydrate of soda, the filtrate contains no sugar, and the precipitate dissolves readily in the soda-lye; and, if the liquid is heated, all the copper is thrown down as sub-oxide, whilst the sugar is destroyed. If these proportions are exceeded, hydrated oxide of copper is mixed with the precipitate.

Aniline Black Marking Ink.—Dr. Jacobsen.—To prepare this ink the two following solutions are required:—(1.) Dissolve in 60 grms. of water 8.52 grms. crystalline chloride of copper, 10.65 grms. chlorate of soda, and 5.35 grms. chloride of ammonium. (2.) Dissolve 20 grms. hydrochlorate of aniline in 30 grms. of distilled water, and add 20 grms. solution of gum arabic (1 part of gum to 2 of water), and 10 grms. glycerin. If 4 parts of the aniline liquid are mixed in the cold with 1 part of the copper solution we obtain a greenish liquid, which may be used at once for marking linen; but as it decomposes in a few days it is better to preserve the two solutions separately. The writing is at first greenish, but is blackened by exposure to steam (e.g., by being held over the spout of a boiling kettle). A dry heat renders the tissue brittle.

Means of Promoting the Germination of Seeds.—A dilute solution of ammonia, potash, or soda, has a remarkable power of hastening the sprouting of seeds, especially of coffee, which germinate with difficulty.

Action of Acids on the Essence of Peppermint.—From the *Journal of the Chemical Society*.

Action of Bromine in Presence of Water on Bromo-Pyrogallol and Bromo-Pyrocatechin.—Dr. Stenhouse.

Action of Bromine on Pyrocatechic, Gallic, and Tannic Acids.—Dr. Stenhouse.

Propionic Coumarin, and on Certain of its Derivatives.—W. H. Perkin.—These three papers are all taken from the *Journal of the Chemical Society*.

Addition-Product of Propylen to Hypochlorous Acid.—M. L. Henry.

Perbromide of Bromated Acetylen.—M. E. Bourgoïn.—These two papers are taken from the *Comptes Rendus*.

Practical Observations on the Properties of Salicylic Acid.—Dr. Wagner.—An account of the therapeutical applications of this acid, external and internal.

Tempered Glass, and on its Resistance to Blows and to Heat.—A. de la Bastie.—An account of the experiments of M. de Lubac.

Toxicological Detection of the Cyanide of Potassium in Presence of Non-Poisonous Double Cyanides.—Already noticed.

Precipitation of Magnesia.—Dr. Mohr.—From the *Zeitschrift für Analytische Chemie*.

Determination of Chlorine, of the Oxides of Nitrogen, and of Ferrous Oxide in Commercial Iron Mor-dant.—M. H. Vohl.—The chlorine is separated by sulphate of silver, and the filtrate treated with caustic baryta till it has a strongly alkaline reaction. The precipitate is digested for some hours at 100° till it becomes compact. Carbonic acid is then passed through the filtrate to remove excess of baryta, and in the liquid nitrites are tested for with starch-paste and iodide of potassium. If nitrites are present a known quantity of the liquid is evaporated to dryness, and the residue is digested with absolute alcohol, in which nitrite of baryta dissolves, whilst nitrate remains insoluble. In this case, the baryta found in the insoluble part is precipitated as sulphate, and weighed, or determined volumetrically. The total baryta is then found in another portion of the solution of the mixed salts, and the quantities of nitrate and nitrite are thus determined. To determine the ferrous salts, the liquid is diluted with water, and digested with recently precipitated carbonate of lime in a flask provided with a stopper, and with a delivery tube dipping into mercury. When the liquid is clear, and no more gas escapes, it is filtered with the exclusion of air, and the precipitate is washed. The iron in the filtrate is per-oxidised with hydrochloric acid and chlorate of potash, and then precipitated with ammonia.

Determination of Sulphur in Coal and Coke.—M. A. Eschka.—Powder as finely as possible 1 grm. of the sample, and mix intimately with 1 grm. of calcined magnesia and 0.5 grm. of anhydrous carbonate of soda. Heat over the lamp in an open platinum crucible, inclined so that only its lower half may be brought to a red heat. The ignition requires from forty-five to sixty minutes, and the mixture should be stirred every five minutes with a platinum wire. The process is complete when the ash becomes yellowish or brownish. Let it become quite cold, and mix intimately with the ash, by means of a glass rod, $\frac{1}{2}$ to 1 grm. nitrate of ammonia, and heat to redness for five to ten minutes, the crucible being covered with its lid. The residue is then placed in a precipitating glass and covered with water. The residue adhering to the crucible is detached by heating with the liquid, and the washings are added to the solution in the glass. The sulphuric acid is then determined in the usual manner.

Les Mondes, Revue Hebdomadaire des Sciences.
No. 14, April 8, 1875.

Analysis of Sugars.—Emile Viard.—The maximum of exactitude is reached by using, for crystalline samples, the saccharimeter with penumbrae (with inversion for the analysis of beet-root and of cane sugars); for glucose, the liquid of Monier, which is preferable to every other; for moisture, the stove of Weissnegg; and for the ash, the sulphuric incineration. Here there is a doubt whether we

should deduct from the weight of the sulphated ash one-tenth or two-tenths.

Magneto-Faradic Apparatus of Clarke as Modified by Gaiffe.—This paper requires an illustration.

Statical Electricity.—Prof. Volpicelli.—This paper also requires the accompanying illustrations.

No. 15, April 15, 1875.

M. Alvaro Reynoso recommends the use in agriculture of lepidolite, a mineral said to contain fluorine, potash, lithia, *nitridium*, and phosphoric acid. Its present price is declared quite unimportant, since "whenever a substance has entered into ordinary use its price has fallen." The escape of fluorine from phosphate is said to considerably reduce their fertilising value.

Manure for Beet-Root.—

Acid phosphate of lime.. ..	300 kils.
Chloride of potassium	200 "
Nitrate of soda	500 "

Liebig's Annalen der Chemie und Pharmacie.
Band 176, Heft 2, April 5, 1875.

Communications from the Laboratory of Prof. V. Meyer, in Zürich.—These communications consist of investigations on the constitution of the bi-substituted benzols, by Dr. C. Wurster; and of a paper on the mercaptanesters, by Dr. W. Michler.

Notice on Substituted Phenols.—Theodor Petersen.—A reply to certain remarks of A. Faust on the dinitrochlorphenols. (*Berichte*, 6, 369; *Liebig's Annalen*, 173, 318, and 157, 161.)

Behaviour of the Solutions of Certain Substances with Polarised Light.—O. Hesse.—(Conclusion.) This valuable paper is not capable of useful abstraction.

Improvement in Erdmann's Floats.—The author, admitting the value of Erdmann's floats in reading off the position of the liquid in a burette, points out that they are open to one serious objection. They generally become lined internally with a green or yellow layer, from the oxidation of the mercury, and are thus rendered opaque, and consequently useless. He proposes to place the mercury in a distinct cell, hermetically sealed from the upper part of the float which carries the circular mark. He has had floats of this construction in use for years.

Analysis of the Sulphuretted Water of Ber. Keraui, in the Libyan Desert.—Julius Hessert.—1000 parts of this water contain—

Free sulphuretted hydrogen	0.0182
Chloride of potassium	0.1344
Chloride of sodium	1.1223
Bicarbonate of lime	0.7480
Sulphate of lime.. ..	1.0722
Bicarbonate of magnesia.. ..	0.0962
Sulphate of magnesia	0.2373
Bicarbonate of iron (protoxide) ..	0.0555
Alumina	0.0236
Phosphoric acid.. ..	0.0051
Silica	0.0327
Organic matter	0.0756
Nitric acid	trace
Lithia	trace

MISCELLANEOUS.

Sulphide of Antimony versus Binoxide of Manganese.—In the Irish Court of Queen's Bench, on May 29th, a motion was made and granted to draw out of court a sum of £1500 tendered by the Governor and Directors of the Apothecaries Hall of Ireland as compensation for the consequences of their mistake in selling a packet of sulphide of antimony for oxide of manganese. Through the explosion of the sulphide, a man, named Marsden, lost his life, and his wife and children were wounded.

The Sulphur-Beds of the Island of Saba.—We have received an interesting description, by Professor Gesner, of a visit made by him to the sulphur-beds of the Island of Saba. He says—"Our destination was Spring Bay, where the beds of sulphur bearing gypsum show their greatest outcrop, and Great Hole, which adjoins it. The men were engaged in removing the overburden, some eight feet of sand and gravel, when we arrived, and in breaking down the crude brimstone from the face of the bed, which is 40 feet in thickness at this point, and extends into the hill under the volcanic cap for an indefinite distance. Going towards Flat Point, which lies between Great Hole and Spring Bay, and descending the cliff a little, one can obtain a view of the face of the vast bed of brimstone, which shows the yellow features in all the places when the overburden has been removed, and in weather-worn places stands out distinctly. At one place a fissure nearly 2 feet in width, lined with yellow crystal so far as we could see, was sounded with a line for 40 feet. The mass of the bed is gypsum, bearing sulphur to a greater or less degree, 60 per cent being the average of sulphur. In many places masses of sulphur, quite pure and resembling melted brimstone, poured into irregular moulds, could be had, hundreds of pounds in weight. The fires died out in Saba so long ago that the sulphur-beds are perfectly cold, and no gases arise to interrupt the working of the sulphur quarry, the workmen carrying on their operations as easily as if in a bank of stiff clay. We trace the bed to Flat Point, and agree as to what Spring Bay will show when its outcrops have been explored with pick and shovel. We discuss the shipping facilities, and agree that a wire tramway from the edge of the quarry to Green Key will be the way to do the transportation to the lighters. I have seen what I believe to be one of the largest, and certainly the richest and most accessible, deposits of brimstone in the world." Mr. G. G. Blackwell sends us the following:—

Analysis of Saba Sulphur.

No. 1.

Sulphur	80.57
Silicate and sulphate of lime	14.90
Water	4.53
	100.00

No. 2.

Sulphur	75.81
Silicate and sulphate of lime	20.56
Water	3.63
	100.00

MEETINGS FOR THE WEEK.

MONDAY, June 14th.—Geographical, 8.30.

TUESDAY, 15th.—Zoological, 8.30.

WEDNESDAY, 16th.—Meteorological, 7.

THURSDAY, 17th.—Royal, 8.30.

— Zoological, 4.

— Philosophical Club, 6.

Chemical, 8. "On Nitrosyl Bromide and on Sulphur Bromide," by M. M. P. Muir. "Notes on the Chemistry of Tartaric and Citric Acids," by R. Warrington. "On the Action of Nitric Acid on Copper, Mercury, &c., especially in the Presence of Metallic Nitrates," G. J. J. Ackworth. "Decomposition of Water by the Joint Action of Aluminium Iodide, Bromide, or Chloride, including Instances of Reverse Action," by Dr. Gladstone and Mr. Tribe. "On Achrematite, a new Molybdo-Arsenate of Lead." "New Reactions of Tungsten," by Prof. Mallet. "On the Action of Chlorine on Acemate," by E. W. Prevost.

GEOLOGY.—Elementary Collections to illustrate the new edition of Lyell's "Students' Elements of Geology," and facilitate the important study of this science, can be had at 2, 5, 10, 20, 50, to 1000 guineas. Also single specimens of Rocks, Minerals, Fossils, and recent Shells. Geological Maps, Hammers, all the recent publications, &c., of J. Tennant, Mineralogist to Her Majesty, 149, Strand, London.

Practical Instruction is given in Geology and Mineralogy by Professor Tennant, F.R.G.S., at his residence, 149, Strand (W.C.).

THE CHEMICAL NEWS.

VOL. XXXI. No. 812.

THE ACTION OF NESSLER TEST ON RAIN-WATER.

By WILLIAM H. WATSON.

I HAVE read Mr. Thomas Garside's "Laboratory Notes," in CHEMICAL NEWS, vol. xxxi., p. 245. The second paragraph is on the "Action of Nessler Test on Rain-Water," he having noticed a muddy appearance produced in rain-water on addition of the Nessler reagent, for which he is unable to account. I have observed very often the same effect with spring- as well as rain-water, and find that it is due to salts of magnesia present in the water. A very slight amount of magnesium chloride in a sample of water produces a distinct muddiness with the Nessler test. Rain-water doubtless obtains its magnesia for the most part in the form of chloride from spray from the sea, and Mr. Garside's sample, collected at Southport (near to the sea), would very likely be pretty considerably contaminated with magnesium chloride.

Below are the analyses of two samples of rain. No. 1, fallen about a mile from the sea; No. 2, fallen about 50 yards from the sea, at Braystones, near Whitehaven.

No. 1.

	Parts per 100 000 parts.
Total solids	5.67
Containing—	
Sodium chloride	2.45
Magnesium chloride	0.67

No. 2.

Total solids	17.10
Containing—	
Sodium chloride	12.20
Magnesium chloride	3.43

Chemical Laboratory, Braystones, near Whitehaven,
June 7, 1875.

NATIVE SODIUM NITRATE, OR "CALICHE."

By Dr. A. T. MACHATTIE, F.C.S., Glasgow.

ANALYSES of native sodium nitrate, or *caliche*, by which latter term it is known in South America, are not very numerous in chemical text-books; and, as I have had occasion to examine some samples brought direct from Peru, a note of the results may be of sufficient interest for record.

The samples were—(1) *White caliche*, in solid compact masses; (2) *brown caliche*, in masses not so compact as the white, mixed with a considerable amount of earthy matter, and having an appearance somewhat similar to impure rock-salt; and (3) a sample of *mother liquor* obtained during the treatment of the white caliche above mentioned, in Peru, previous to shipping the crude nitrate for exportation.

Analyses.

	No. 1. White Caliche.	No. 2. Brown Caliche.
Sodium nitrate	70.62	60.97
Sodium iodate	1.90	0.73
Sodium chloride	22.39	16.85
Sodium sulphate	1.80	4.56
Calcium sulphate	0.87	1.31
Magnesium sulphate	0.51	5.88
Insoluble matter	0.92	4.06
Water	0.99	5.64
	100.00	100.00

The iodine appeared to exist almost entirely as sodium iodate.

The *mother liquor* (No. 3) had the sp. gr. 1.440.1 (water=1000), and five samples gave, as an average of closely accordant results, 0.56 per cent of iodine, equivalent to sodium iodate, 0.873. In this case, also, the iodine appeared to be present in the condition of sodium iodate.

REPORT

ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from page 255).

THE air is driven, by means of a blast, at a pressure of 3 to 4 c.m. of mercury through a sheet-iron box filled with caustic lime, and then conducted into the retort from above. The temperature of the latter can be judged by means of an aperture, which can be closed with an iron stopper. The air gives off only about the half of its oxygen, so that, for 1 volume of oxygen, 10 volumes of air must be passed through, the residue escaping into the atmosphere.† In about five minutes the revivification of the reduced mass is completed, when the stream of air is cut off by means of a cock with a triple perforation, and a current of superheated steam is passed through for five minutes, whilst immediately afterwards the gas which issues below the grate is conducted into condensers. Here a fine descending rain of cold water frees the oxygen from steam, and it enters the gasometer under the pressure of a column of water of from 8 to 10 c.m. in height. In this manner, reduction and oxidation alternate at intervals of five minutes. Not until six hours have elapsed does it become necessary for a more complete revivification of the mass to pass atmospheric air over it for an hour, for in five to six hours the yield of oxygen sinks from its original quantity down to the half, or even the third. The cocks are set at Vienna by a self-acting movement. The longer watery vapour is introduced, and the retorts thus freed from atmospheric air before opening the communication with the gasometer, the purer is the oxygen. Half a minute suffices to bring down the nitrogen to 15 per cent if the useless space in the retorts is kept as small as possible. If, as is easily practicable, the nitrogen is brought down to 4 per cent, there is a greater waste of oxygen. To be certain that the amount of nitrogen remains within the limits of from 10 to 15 per cent, samples are taken from the gasometer in graduated tubes, and the oxygen is absorbed by means of known quantities of potash and pyrogallous acid, a reaction which, even in inexperienced hands, gives quick and accurate results.

As any cooling of the retorts below a dark red heat diminishes the yield, care is taken to heat both the air and steam to about 300° C. At Pantin, where there are several groups of ten retorts each, two of them are filled with pumice-stone, and serve for heating the air and the steam. The composition of the mass is 2 molecules of NaOH, 1 molecule of MnO₂, and the fifth of a molecule of oxide of copper, which merely serves to separate the other ingredients and render them more accessible to the influence of steam and air. At Comines, the black oxide of manganese is regenerated in the ordinary manner from chlorine residues, and is almost pure; its price is 2 francs per kilo. The great cost of this fundamental article is not of importance, since it can be used the longer the more carefully the air is freed from carbonic acid. If, in con-

* "Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends."

† Latterly, Tessié du Motay has attempted to convert the escaping nitrogen industrially, first into nitride of titanium, and then into ammonia.

sequence of some inevitable interruption of the process, the mass absorbs atmospheric carbonic acid, it is simply requisite to heat to redness, and to pass a current of steam over it till the escaping vapours cease to render lime-water turbid. The temperature is then raised and air passed over the mass, when it regains its original efficacy. The average duration of a retort is one year.

Tessié du Motay's process yields oxygen at 90 per cent, at the cost of 15 to 30 centimes per cubic metre,* or, according to the experiments of Kuppelwieser in Vienna,† 3 florins per 1000 cubic feet, a price which agrees with the former, and which scarcely exceeds that of coal-gas. We may regard this process as the final and successful solution of the problem as to the economical and rational production of oxygen.

We have still to review a group of projects which, without any chemical agents, aim at extracting oxygen from the atmosphere by a purely mechanical procedure. They are based upon two physical principles, diffusion or absorption.

THE CHEMICAL CONSTITUTION

OF THE ETHYL-ETHER AND ITS CHLORINATED DERIVATIVES,

VIEWED AND INTERPRETED FROM THE STANDPOINT OF THE
"TYPO-NUCLEUS" THEORY.

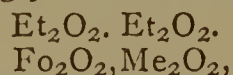
By OTTO RICHTER, Ph.D.

(Concluded from page 247.)

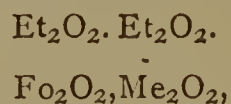
PART II.

On the Chemical Action of Sodium-Ethylate on the Chlorinated Derivatives of the Ethyl-Ether and the so-called Acetal, as also on the Mode of Formation and Molecular Structure of the Ether-Salts of Ortho-Formic and Ortho-Carbonic Acids.

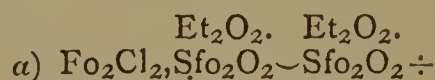
When the mono-chlor-ethyl-ether is treated with sodium-ethylate, the resulting product is acetal—



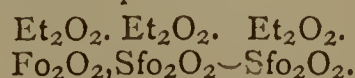
and with similar treatment the dichlor-ethyl-ether is observed to furnish chlor-acetal—



the molecular changes consisting, in either case, in the interchange of the sodium nucleus for the formyl nucleus of the colligated formyl chloride. And, considering that, like hydrate of potash, the sodium ethylate possesses, in its soda constituent, a powerful chlorine-coveting base, I have, further, been led to infer the existence of three varieties of chloracetal—

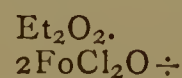


corresponding to the three aforesaid varieties of hydroxyl-chlor-ether. Manifestly, the action of a second molecule of sodium-ethylate on either of these three isomerides ought to yield the same product—

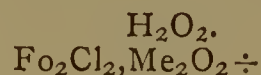


It is interesting to learn that this body, which is evidently the tri-ethyl-ether of the triatomic ethyleneglycolic alcohol, has actually been got and described under the name "tri-ethyl-acetal." In order to enable the reader of comprehending the precise nature of the action of sodium-ethylate on dichlor-acetal, which according to Pinner, gives rise to "glyoxal-acetal," it becomes incumbent on me to explain to him the formation of Kay's orthoformic ether. This compound is best obtained by dropping the calculated quantity of sodium into a mixture of absolute alcohol and formyl-chloride (chloroform), 2FoCl_3 , when three molecules of previously-formed sodium-ethylate conspire towards the production of one molecule of the ether and three molecules of sodium-chloride, the molecular changes being briefly as follows:—

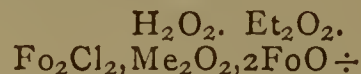
First stage.—Interchange of ethoxyl, Et_2O_2 , for chlorine, producing sodium-chloride, and dichloro-formic ether—



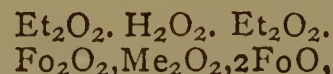
Second stage.—Splitting-up of the latter into the formous ether and two molecules of chlorine, which, by reacting upon the ethylen adjunct of the second molecule of sodium-ethylate, give rise to hydrochloric acid and sodium-chlor-ethylate, and, by the transposition of the latter products, to a second molecule of sodium-chloride and the unstable chlor-ethylic alcohol, which speedily merges into the isomeric hydrate of ethylen-oxy-chloride—



Third stage.—Chemical union of this hydrate with the aforesaid formous ether, yielding—

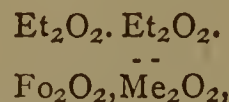


Fourth stage.—Interchange of the third molecule of sodium-ethylate for the formyl nucleus of the colligated formyl-chloride, giving as end-product the ortho-formic ether—

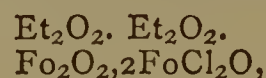


and a third molecule of sodium-chloride.

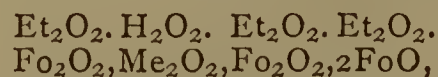
This formula will now enable us to resume our enquiry into the molecular structure of Pinner's glyoxal-acetal. Assuming that, under the stimulus of the sodium-ethylate, the dichlor-acetal—



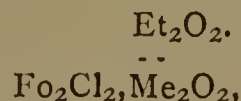
passes first into the isomeric modification—



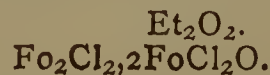
into which the before-mentioned dichloro-formic ether is seen to enter as one of the principal groups, and having just shown that the action of two molecules of sodium-ethylate on that ether gives birth to a molecule of ortho-formic ether, it becomes clear that Pinner's compound must be constituted according to the formula—



which represents it as the ethyl-ether of ortho-ethylglycolic acid. It is almost superfluous to add, that the same substance ought to be obtainable likewise by the action of sodium-ethylate on the trichlor-ethyl-ether—



or, more correctly speaking, on the isomeric modification—

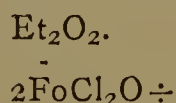


* Phillips, "Der Sauerstoff," 18.

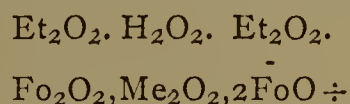
† Kuppelwieser, *Berg. und Hütten Ztg.*, 1873, 354.

In passing on to consider the action of sodium-ethylate on trichlor-acetal, I must confess to my want of success in gathering reliable experimental data; nevertheless, I have attempted the solution of this problem on the strength of the theoretical knowledge already gained, and, being struck with the close resemblance and evident parallelism which this case bears to the last, I have naturally been led to think that similar relations to those subsisting between the ortho-formic and ortho-ethyl-glycolic ethers might obtain likewise between the ortho-carbonic and ortho-ethyl-glyoxylic ethers, it being taken for granted that the latter combination was obtainable by the action of sodium-ethylate on trichlor-acetal. Commencing, therefore, with the ortho-carbonic ether, which may be realised by subjecting chlor-formyl-trichloride (tetra-chloride of carbon) 2FoCl_3 , to the action of sodium-ethylate, the molecular changes are briefly as follows:—

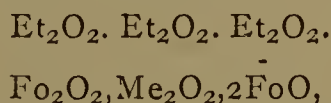
First stage.—The interchange of ethoxyl for chlorine gives rise to sodium-chloride and the trichloro-formic ether—



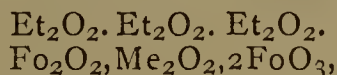
Second stage.—Two molecules of sodium-ethylate, by reacting upon the latter, produce two molecules of sodium-chloride and the ortho-chloro-formic ether—



Third stage.—The fourth molecule of sodium-ethylate, by the interchange of its ethyl nucleus for the hydrogen nucleus of the colligated methylic alcohol, gives birth to hydrate of soda and the product—

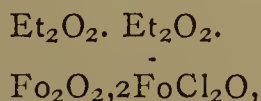


whereupon the interchange of hydroxyl for chlorine completes the formation of the ortho-carbonic ether—

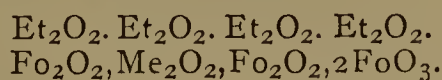


while a fourth molecule of sodium-chloride is added to those previously formed.

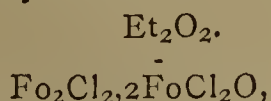
This formula will now enable us to resume our enquiry into the molecular structure of the hypothetical ortho-ethyl-glyoxylic ether. Assuming that it is not the ordinary dichlor-acetal, but the above-mentioned isomeric modification, which is brought to furnish the trichlor-acetal—



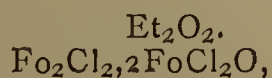
into which the trichloro-formic ether is seen to enter as one of the principal groups; and having just shown that the action of three molecules of sodium-ethylate on that ether gives birth to a molecule of ortho-carbonic ether, it becomes clear that the ether in question must be constituted according to the formula—



It is almost superfluous to add, that the same body ought to be obtainable likewise by the action of sodium-ethylate on the tetra-chlor-ethyl-ether—



which I take to be a substitution-product of the isomeric modification—



of the trichlor-ethyl-ether.

In drawing to a close, I may yet be permitted to notice one other important feature of the new theory, which is

that, according to my definition of an alcohol, whereby it is viewed as a combination of two molecules of water, one or both the hydrogen nuclei of which have become dissimilarly modified by their chemical union with different hydrocarbon or halogen adjuncts, the alcoholic family includes amongst its members, not only the alcohols proper, but likewise the so-called mixed ethers. But, in striking contrast with this class of saline molecules, the chemical constitution of another class of saline molecules, comprising water, the ethyl-ether, hydrochloric acid, and ethyl-chloride, has now, I think, been fully determined and substantiated by a host of solid and weighty experimental evidence; and thus the most salient structural points and peculiarities of these prototypes of molecular arrangement have become revealed to us, at least so far as the mere juxtaposition of marks and symbols on a plane surface can be expected to accomplish it. On these grounds, I would fain persuade myself that my theory regarding the chemical constitution of the ethyl-ether and its chlorinated derivatives, although at variance with current notions and prejudices, will yet receive a full share of that serious attention and thoughtful consideration which is often so liberally and enthusiastically accorded to chemical problems of minor import and significance.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

June 12, 1875.

Professor GLADSTONE, F.R.S., President, in the Chair.

The Lord LINDSAY, Sir W. Thomson, and Prof. Sylvester were elected members.

Mr. WILDMAN WHITEHOUSE described some experiments he had made "*On the Electric Conductivity of Glass.*" He employed pieces of thermometer tube about an inch in length, into the bore of which two platinum wires were inserted in such a manner that there was an interval between the points. In some cases one wire of platinum occupied the entire bore of the tube, and the tube was surrounded on its external surface by a helix of wire of the same metal. In each case the arrangement was introduced into a circuit in which were also placed a Thomson galvanometer and a set of resistance coils. It was shown that at the ordinary temperature there was no deflection, but that the current passed freely when the glass was heated to redness. The difficulty of making contact with the glass led Mr. Whitehouse to use two test-tubes, one inside the other, both containing mercury with which wires of platinum freely communicated. The flame of a Bunsen burner was applied to the outer test-tube, and the temperature of the metal noted by the aid of a thermometer. In one series of experiments the diameter of the internal tube was $\frac{1}{8}$ inch, the length in contact with the mercury about $3\frac{1}{4}$ inches, and the thickness of the glass $\frac{1}{160}$ th of an inch. A current was first observed to pass at 100°C. , and, as the temperature rose, the amount of deflection increased. The following are approximate measurements of the resistance of the glass at different temperatures:—

				Ohms.
At	165°C.	resistance	.. ..	229,500
"	185 "	"	.. ..	100,000
"	210 "	"	.. ..	69,000
"	255 "	"	.. ..	22,500
"	270 "	"	.. ..	9,000
"	300 "	"	.. ..	6,800

Prof. GLADSTONE drew attention to the necessity for ascertaining the nature and composition of the glass.

Prof. GUTHRIE alluded to the fact that electricity of high tension is freely conducted by glass at a red heat. He also asked whether, as the temperature was raised, a point was reached at which the conductivity began to decrease.

Prof. McLEOD pointed out that most of the tubes in which the platinum wires were fixed were of lead-glass, and that the lead had in most cases been reduced by exposure to the flame employed and he urged that this fact should not be overlooked in measuring the resistances. He stated that lead-glass is better than other varieties of glass for insulation.

Prof. G. C. FOSTER asked whether an increased capacity due to the heating might not introduce an error into the measurements of resistance.

Mr. WHITEHOUSE replied that he had only recently commenced the experiments, and promised that the suggestions which had been made should receive due attention.

The PRESIDENT then read a paper on "*The Time Required for Double Decomposition of Salts*." It is well known that if, on mixing solutions of two salts M R and M' R', an insoluble body can be produced by an interchange of metals and radicals, that body is produced to the fullest extent possible. The only explanation of this fact which has been given is founded on the theory of Berthollet, that in all cases of mixture there is a redistribution of the constituents according to their relative affinity and mass, with the production of more or less M R' and M' R. Now if one of these, say M R', be insoluble, it will remove itself at once from the sphere of action, but this will necessitate a fresh distribution of the constituents, with the production of more insoluble salt, and so on until the whole of the M has entered into combination with R'. Dr. Gladstone commenced this research twenty years ago, and stated in a note to a paper in the *Philosophical Transactions*—"It is easily conceivable that when the affinity for each other of the two substances that produce the insoluble compound is very weak, the action may last some time and become evident to our senses. Is not this actually the case when sulphate of lime in solution is added to nitrate of strontia, or carbonate of soda to chloride of calcium, or an alkaline carbonate to tartrate of yttria, or oxalate of ammonia to sulphate of magnesia, &c.?" The President gave several experimental illustrations of the time required for double decomposition. He showed that ferric chloride and sulphocyanide of potassium react instantly; that citrate of iron and meconic acid, chloride of platinum and iodide of potassium react gradually. The rate of change really depends on the degree of rapidity of the inter-diffusion of the salts. It is also affected to a very great extent by temperature. The following numbers illustrate the rate at which sulphate of strontium is deposited on the addition of sulphate of calcium to a solution of nitrate of strontium.

Cloud .. in 4 minutes.

0.071 grms.	..	20	..
0.130	..	60	..
0.303	..	110	..
0.497	..	270	..
0.659	..	1270	..

The total amount of salt which could be formed being 1.5 grms.

Quantitative Analysis of Cinnabar.—F. Gramp.—The author attacks cinnabar with nitric acid in a sealed tube, thus producing sulphuric acid, which is then determined as sulphate of baryta. The operation was perfectly and easily completed on heating the sample for two hours to 120° with nitric acid of specific gravity of 1.4. The nitric acid was then evaporated off, and the sulphuric acid thrown down with chloride of barium, after addition of hydrochloric acid. The excess of baryta is then removed with sulphuric acid, and the mercury precipitated with phosphorous acid, and weighed as calomel.—*Moniteur Scientifique*.

SOCIETY OF PUBLIC ANALYSTS.

ON THE MINIMUM OF SOLIDS IN MILK.

By J. CAMPBELL BROWN, D.Sc.,

Lecturer on Chemistry and Toxicology in the Liverpool Royal Infirmary School of Medicine.

THE determination of the minimum—not the average—quantity of nutritive constituents in milk yielded by healthy cows is the necessary foundation of the standard by which adulterated milk may with certainty be judged. The milk yielded by cows in the large towns, where the cows are necessarily stall fed, is almost invariably much richer than that yielded by cows fed in the country. But the towns are always supplied, in part, with milk brought by rail or carts from the country; and as there are no means of analytically distinguishing with certainty between town and country milk, the country minimum must necessarily form the standard by which all milk, whose source is not absolutely known, must be judged.

Soon after the passing of the Adulteration Act of 1872, I obtained authentic samples of milk in Lancashire and Cheshire, which led me to adopt a standard slightly below that which has since been adopted by very many Analysts. I therefore think it desirable to place some of the details on record, not so much with the view of objecting to the standard so frequently acted upon as the basis for calculating the quantity of water added in the adulteration of milk, as of showing that this standard must be used with great caution in instituting prosecutions when the quantity of added water is small.

With regard to the method of analysis, I am perfectly satisfied with that described by Wanklyn, provided that 40 or 50 c.c. be taken for analysis, and that it be weighed, and the results be expressed in parts by weight. The dry residue should be kept in an air-bath at 99° C. for at least an hour before being weighed.

The following three samples are the poorest authentic samples out of three or four hundred which I have examined. In all cases the cows were properly milked under the inspection of persons on whom I can rely.

No. 1 is the mean of two concordant analyses of a sample of milk taken in November from a single cow fed with grass and grains; the property of a private gentleman. The cow had not calved for two years, and had nearly ceased giving milk.

No. 2 was milk taken in April, in the presence of a sergeant of police, from eight cows belonging to a farmer, who had been prosecuted, who knew three days before that a sample would be taken in presence of the police, and whose interest it strongly was so to feed his cows that they should yield as watery milk as possible on the day when the sample was to be taken. The milk was sealed up, and brought directly to me by the police.

No. 3 was milk taken in May from nine cows, in the presence of an inspector, at the request of a farmer.

	Total Solids.	Cream. Per Cent.	Fat.	Solids not Fat.
No. 1.	.. 11.10	under 8	2.16	8.94
No. 2.	.. 11.36	about 9	2.41	8.95
No. 3.	.. 11.55	—	2.74	8.81

It appears, therefore, that 1 per cent of the milk yielded by healthy cows in Lancashire and Cheshire would be considered slightly adulterated if rigidly judged by the common standard; but that no sample from healthy cows, even under the most unfavourable circumstances, yielded less than 11 per cent total solids.

The following table, which is constructed on the supposition that the milk to which water has been added originally contained only the low minimum of 11 per cent total solids, will be found useful in readily stating the minimum amount of added water in adulterated milk. It may be read thus:—If analysis shows that a sample of milk contains a passable amount of cream, and the total

amount of solids found in the first column, then the sample contains less than the proportion of natural liquid constituents stated in the second column, and more than the proportion of added water stated in the third column; it is therefore adulterated by the addition of upwards of the amount of water stated in the fourth column to 100 parts of the poorest milk.

For instance, if analysis shows that a sample of milk contains 8.46 per cent of solid constituents, including, say, 1.8 per cent of fat, then it contains less than 68.47 per cent of the natural liquid of milk, and more than 23.07 per cent of added water. It is therefore adulterated by the addition of upwards of 30 parts of water to 100 parts of the poorest milk.

TABLE SHOWING THE ADULTERATION BY WATER OF MILK WHICH ORIGINALLY CONTAINED THE MINIMUM OF 11 PER CENT OF SOLIDS, INCLUDING FAT.

Percentage of Solids and Fat found by Analysis.	Maximum Percentage of Natural Liquid of Milk Present.	Minimum Percentage of Water from the Pump Present.	Minimum Quantity of Water Added as an Adulteration to every 100 parts of the Poorest Milk.
11.00	89.00	—	—
10.89	88.11	1.00	1.00
10.78	87.22	2.00	2.04
10.67	86.33	3.00	3.09
10.56	85.44	4.00	4.16
10.48	84.76	4.76	5.00
10.34	83.66	6.00	6.38
10.23	82.77	7.00	7.52
10.12	81.88	8.00	8.69
10.01	80.99	9.00	10.00
9.90	80.10	10.00	11.10
9.79	79.21	11.00	12.35
9.68	78.32	12.00	13.63
9.50	77.31	13.13	15.00
9.46	76.54	14.00	16.22
9.35	75.65	15.00	17.64
9.24	74.76	16.00	19.04
9.16	74.16	16.60	20.00
9.13	73.87	17.00	20.48
9.02	72.98	18.00	21.95
8.91	72.09	19.00	23.45
8.80	71.20	20.00	25.00
8.69	70.31	21.00	26.58
8.58	69.42	22.00	28.20
8.46	68.47	23.07	30.00
8.36	67.64	24.00	31.58
8.25	66.75	25.00	33.30
8.15	65.92	25.93	35.00
8.03	64.97	27.00	36.98
7.86	63.57	28.57	40.00
7.70	62.30	30.00	42.85
7.58	61.39	31.03	45.00
7.48	60.52	32.00	47.06
7.30	59.30	33.30	50.00
7.26	58.74	34.00	51.50
7.09	57.43	35.48	55.00
7.00	56.63	36.36	57.14
6.87	55.63	37.50	60.00
6.70	54.61	38.65	63.00
6.60	53.93	39.39	65.00
6.47	52.36	41.17	70.00
6.28	50.87	42.85	75.00
6.10	49.40	44.40	80.00
5.94	48.15	45.90	85.00
5.79	46.84	47.37	90.00
5.64	45.64	48.72	95.00
5.50	44.50	50.00	100.00
5.23	42.39	52.38	110.00
5.00	40.45	54.55	120.00

Percentage of Solids and Fat found by Analysis.	Maximum Percentage of Natural Liquid of Milk Present.	Minimum Percentage of Water from the Pump Present.	Minimum Quantity of Water Added as an Adulteration to every 100 parts of the Poorest Milk.
4.78	38.70	56.52	130.00
4.58	37.09	58.33	140.00
4.40	35.60	60.00	150.00
4.23	34.22	61.55	160.00
4.07	32.96	62.97	170.00
3.93	31.79	64.28	180.00
3.79	30.69	65.52	190.00
3.60	29.60	66.60	200.00
3.44	27.81	68.75	220.00
3.23	26.18	70.59	240.00
3.06	24.72	72.22	260.00
2.89	23.43	73.68	280.00
2.75	22.25	75.00	300.00
2.58	20.95	76.47	325.00
2.40	19.70	77.70	350.00
2.31	18.75	78.94	375.00
2.20	17.80	80.00	400.00
2.00	16.18	81.81	450.00
1.83	14.83	83.30	500.00
1.57	12.72	85.71	600.00
1.37	11.13	87.50	700.00
1.20	9.91	88.80	800.00
1.10	8.90	90.00	900.00
1.00	8.10	90.90	1000.00

"The Sale of Food and Drugs Bill," in a state virtually unaltered from that in which it was sent up by the Lower House, passed through Committee in the House of Lords on the 15th inst.

CORRESPONDENCE.

POLARISED LIGHT.

To the Editor of the Chemical News.

SIR,—The relations of polarised light to chemistry and physics are so intimate and interesting, that any novel application of it, even though not of apparent utility, may, I hope, be acceptable to your readers.

I would then very briefly draw attention to an adaptation which I made, about two years since, of this form of light to the well-known and beautiful optical instrument, the kaleidoscope, but which I have not before published.

This instrument, I need hardly observe, consists of a tube, within which are fixed at an angle representing an aliquot part of a circle, two or three plane mirrors, blackened on the outside, so as to give by repeated reflection symmetrical and constantly varying images of pieces of coloured glass or other transparent objects, placed in a cell at one end of the tube, the images being viewed through a small aperture at the opposite end.

Now it occurred to me, at the time referred to, that if pieces of selenite were substituted for the fragments of coloured glass, and polarised light were made to pass through the instrument, there would be seen, with the aid of an analyser, the beautiful colours given by that familiar double-refracting substance, reflected like those of ordinary light. Accordingly I selected films of selenite, presenting, when analysed, various colours corresponding with their respective thickness, and mounted them on pieces of thin crown glass of different shapes and sizes, placed them in the cell of a kaleidoscope, and adapted a tube to the other end so as to receive a second tube fitted with

small Nicol prism, or a tourmaline. I then found, as I had anticipated, that when light polarised by a plate of glass, or even by a cloudless sky, was transmitted through the cell, the reflected images of the selenite mountings were symmetrically and beautifully displayed.

To enlarge these polarised images, and to increase the strength of their colours by concentrating the rays, I have adapted in some of my instruments a lens of appropriate focus to the eye-end of the tube just below the Nicol, or analyser, but this addition is not in the least necessary.

Having referred to the polarised light of the sky, it may not be irrelevant to mention that not only in the bright azure of the morning it is beautifully displayed by my kaleidoscope, but even in the misty blue of the evening it is clearly and vividly revealed. At the present season, for instance, the colours given by the instrument may be seen in all their depth and beauty as late as half-past seven or eight o'clock in fine evenings. Indeed, the polarised images are in bright cloudless weather often brought out with greater intensity in the late evening than in the morning or afternoon. This fact appears, I think, to prove that the polarisation of the light of the sky is dependent upon aqueous vapour suspended in the atmosphere in a very fine state of condensation, and not, as Professor Tyndall supposes, upon some unknown body called by him "sky-matter."

Apologising for so far intruding upon your valuable columns.—I am, &c.,

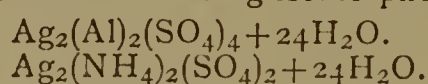
W. H. OLLEY.

Stoke Newington, June 2, 1875.

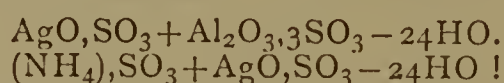
THE ALUM TYPE.

To the Editor of the Chemical News.

SIR,—Will any one kindly inform as to the legitimacy or correctness of the two following isomorphous salts?—



The difference of character may, perhaps, be better seen by using the old notation—



As the silver-ammonium alum of M. Sergius Kern puzzles from a new monatomic point of view, so also does M. Roessler's indium-alum from a triatomic point of view.

With an evident clerical mistake in the notation, and no weights given, it is difficult to decipher the interesting novelty. If M. Roessler be correct, the indium weight should be 226.8, whereas, from another point of view, it should be 75.6 or 151.2!

Any information on these two alums would be very highly esteemed.—I am, &c.,

S. E. PHILLIPS.

LEAD IN TINNED ARTICLES.

To the Editor of the Chemical News.

SIR,—In *Comptes Rendus* for September 12, 1874, M. Fordos states that he has found lead in the tinning of culinary vessels, and that there is a danger of poisoning by the action of dilute acids, such as vinegar, upon the lead.

English tin-plate also contains lead, likewise the pure block-tin pipe used by publicans in their beer-engines. It would seem, however, that, when the lead is present in only small quantity, the tin, being electro-positive, protects the lead during solution; for if a piece of the tin pipe be dissolved in HNO_3 , and the liquid tested from time to time, only a faint yellow colouration is produced by H_2S , while, when the tin is completely oxidised, H_2S gives immediately a black precipitate.

Solder, however, does not act in this manner, pre-

sumably because it contains a very much larger quantity of lead.

It seems possible, therefore, that the presence of a small quantity of lead in tinned articles is not injurious.—I am, &c.,

A. P. S.

THE ACTION OF DILUTE MINERAL ACIDS ON BLEACHING-POWDER.

To the Editor of the Chemical News.

SIR,—Notwithstanding the discussions that arise from time to time on the constitution of bleaching-powder, I venture to think that any one acquainted intimately with the literature of the subject, can have no doubt that its nucleus is truthfully represented by the formula assigned to it by Odling. If a proof were wanted in spite of the previously existing vast analytical data, that proof was furnished by the isolation from bleaching-powder of calcic hypochlorite, in the manner described by me (*Journal of the Chemical Society*, series 2, vol xiii., p 404) at a recent meeting of the Chemical Society, when the crystallised body was exhibited.

I regret I could not stay to hear Mr. F. Kopfer's paper "On the Action of Dilute Mineral Acids on Bleaching-Powder" at the meeting of the Chemical Society on the 3rd inst., and will therefore venture to anticipate the publication of his paper in a measure by asking him to be good enough to point out the novel feature of his experiments. According to the abstract in your columns of the 11th inst., Mr. Kopfer found that pure hypochlorous acid free from chlorine was obtained by distilling a carefully prepared solution of bleaching-powder with dilute acids in the proportion sufficient to liberate only the hypochlorous acid, assuming the formula $\text{Ca} \begin{Bmatrix} \text{Cl} \\ \text{OCl} \end{Bmatrix}$ to be correct. Gay-Lussac has long since shown that hypochlorous acid may be conveniently prepared in this manner (*Comptes Rendus*, xiv., 927) whilst if excess of acid be added chlorine is obtained.

Moreover, Schorlemmer in criticising a paper by Goepner (*Dingler's Polytech. Journ.*, ccix., 204), in a note read before the Manchester Literary and Philosophical Society, has pointed out the same facts; and states even that it is not only a lecture experiment at Owens College, but also an experiment which every student has to perform.

Further, W. Wolters (*Journ. Chem. Soc.*, series 2, vol. xiii., p. 422, from *Dingler's Polytech. Journ.*, ccxiv., 140 to 148) has described experiments in the same direction, at least, and which lead him to a similar view of the constitution of bleaching-powder.

In the face of these facts, I fail to see what is original in Mr. F. Kopfer's experiments; although, of course, the novel feature not being exhibited in the abstract alluded to, may be reserved for publication in the Chemical Society's *Journal*.—I am, &c.,

CHARLES T. KINGZETT.

Kensington, W., June 12, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 20, May 24, 1875.

Dissociation of Methyl-Aniline Violet and its Separation into two Colours under the Influence of Certain Normal and Pathological Tissues, and in Particular by Tissues in a State of Amyloid Degeneration.—M. V. Cornil.—If certain tissues, whether normal or pathological, are stained with methyl-aniline

violet, the latter is dissociated into two colours: a red-dish and a blue violet. Each of these colours is fixed upon certain elements with remarkable constancy. The tone, the intensity, and the permanence of the colouration vary with the tissues examined, as well as with the strength of the solution employed.

Sulphuration of Copper and Iron after a Prolonged Immersion in the Hot Spring of Bourbon l'Archambault.—M. de Gouvenain.—An account of the spring in question, with its action upon Roman coins found lying in the water.

Certain Reactions of the Salts of Chrome.—M. A. Etard.—At present the reactions are not known by which the salts of sesquioxide of chrome can be converted instantly, and at will, from one modification to the other. The green salts only become violet under the influence of nitric acid after the expiration of a longer or shorter time. Certain reagents produce an immediate effect. The green salts become a carmine violet if mixed in the cold with a little nitrite of potash. The carmine tint developed at the moment of the mixture of the two solutions, and which resembles that of the amido-chromic compounds, gradually disappears to give place to the blue-violet which has chrome alum for its type. Sulphocyanide of potassium produces the same phenomena, but more slowly. The green solutions of chrome, if precipitated by potash, give a hydrate insoluble in ammonia, and which, if re-dissolved in acetic acid somewhat concentrated, takes a carmine-violet colour. In this case the carmine tint does not pass into the violet-blue in course of time. Under the influence of the arseniates, or of free arsenic acid, the violet salts become a bright green in a few seconds in the cold, and cannot be brought back to a violet by the nitrites. Nitrate of silver does not precipitate the arsenic acid of these salts. Löwel admits four modifications of hydrate of chrome—two green, one violet-carmine, and one violet-blue. The violet-carmine salt obtained with a nitrite gives with potash a grey precipitate insoluble in ammonia, which distinguishes this salt from the ordinary one violet-blue salt. The light green salt obtained with the arseniates has the equally characteristic property of giving with potash a precipitate insoluble in acetic acid, and soluble in ammonia with a violet-blue—a reaction exactly opposite to that of the ordinary deep green salts.

The Camphenes.—M. J. Ribau.—An account of active lævo-gyratory camphene, of inactive α -camphene, of inactive β -camphene, and of Borneo camphene.

Reaction of Sulphide of Carbon: Transition of Sulphide of Carbon into Hydro-Sulpho-Cyanic Acid.—C. Saint-Pierre and G. Jeannel.—The authors find that sulphide of carbon in contact with ammonia, with nitrate of ammonia and potash, and with nitrate of ammonia and sulphide of potassium, gives rise to a characteristic production of sulphocyanide. In the discussion which followed, M. Dumas remarked that this reaction was well known to chemists, and had been utilised in the manufacture of ferrocyanides.

Moniteur Scientifique, du Dr. Quesneville,
May, 1875.

Synthesis of the Derivatives of Anthraquinon by Means of Phthalic Acid, and the Derivatives of Benzin.—A. Bæyer and H. Caro.—A valuable paper, in which the chemical and physical attributes of erythro-anthraquinon and oxyanthraquinon are contrasted in a tabular form. It is remarked that all the bodies which when heated with sulphuric acid yield hydro-quinol-sulphonic acids furnish quinazarin when anhydrous phthalic acid is added to them. The remarkable procedure employed by Lalande, for transforming alizarin into purpurin, serves likewise for transforming quinizarin into purpurin by heating the former body to 140° with peroxide of manganese and sulphuric acid.

Amides of Diazo-Benzin.—A. Bæyer and C. Jäger.—Not adapted for abstraction.

History of Eosin.—M. A. Bæyer.—Eosin may be considered as tetra-bromated fluorescein. It is remarkable that tetra-brom-orcin-phthalein, a homologue of eosin, is colourless. If eosin is agitated at a gentle heat with water and sodium amalgam the liquid becomes colourless, because the bromine is removed, and colourless fluorescein is formed—the reduction-product of fluorescein. If the liquid is now diluted with water, and a few drops of permanganate are added, the oxidising action of this reagent at once transforms the fluorescein into eosin, and the colourless liquid becomes green and opaque by reflected light.

Dioxyquinon of Chrysen or Chrysezarin.—M. A. Claus.—Chrysezarin is found among the impurities of commercial alizarin to the extent of 3 to 4 grms. per kilo.

Facts Bearing on the History of Beech-Wood Tar.—A. W. Hofmann.—The author shows that cœrulignon is indisputably the cedriret of Reichenbach, to whom the honour of the discovery therefore belongs.

On Cœrulignon.—A. W. Hofmann.—The composition of this body is—

Carbon	63.17
Hydrogen	5.27
Oxygen	31.56
	<hr/>
	100.00

corresponding to the formula $C_{16}H_{16}O_6$.

Action of Concentrated Sulphuric Acid upon Cœrulignon and Hydro-Cœrulignon.—M. E. Fischer.—Cœrulignon dissolves in concentrated sulphuric acid with a blue colour, sulphurous acid being evolved. If the liquid is diluted with water it loses its blue tint and deposits a brown substance, which after a certain time takes a crystalline texture. The same body is obtained on diluting with water the fine red solution of hydro-cœrulignon in sulphuric acid.

Notice on the Camphor of Cubebs.—E. Schaer and G. Wyss.—Not suitable for abstraction.

Method for the Determination of Sulphur of General Applicability.—M. A. Sauer.—The author burns the material in a current of oxygen, and receives the sulphurous acid in hydrochloric acid containing bromine. The details cannot be given without the accompanying engravings.

Researches on the Simultaneous Diffusion of Certain Salts.—C. Marignac.—Reserved for insertion in full.

Fermentation and Putrefaction Considered from a Physiological Point of View.—M. Charles Blondeau.—A very lengthy paper, not adapted for abstraction.

Applications of Chrome in Calico-Printing.—M. A. Schultz.—This paper consists chiefly of practical receipts.

Chemical Products at the Vienna Exhibition.—M. E. Kopp.—(Continued.) The decolouration of blood-albumen for printing purposes, by means of ozonised air, is an interesting application.

Method and Tables for Polarimetric Assays of Beet-Root Juice.—M. E. Perrot.—The author takes 160 c.c. of juice, to which he adds 20 c.c. of a saturated solution of basic acetate of lead, and the same measure of a recent solution of tannin, containing 10 grms. per litre. The liquid is thus obtained perfectly colourless.

Bulletin de la Societe Chimique de Paris,
No. 7, April 5, 1875.

Researches on the Fatty Acids and their Alkaline Salts.—M. Berthelot.—An examination of the amount of heat liberated during the formation of the fatty salts, both in the solid state and in solution.

Anhydrous Acetic Acid.—M. Berthelot.—Already noticed.

Structural Formulæ in Space.—J. H. Van't Hoff.—An examination of the relation between asymmetric carbon and active optical power, and between asymmetric carbon and the number of isomers.

Correspondence from St. Petersburg.—M. W. Louguinine.—In the seventh volume of the *Journal of the Russian Chemical Society* M. Mendeleeff describes the deposits of sphaeroiderite at Kromy, in the Government of Orel. MM. Kamensky and Lund communicate analyses of the iron ores of Gytomir, which contain 59 per cent of metallic iron. M. Beketoff communicates, on behalf of M. A. Elketoff, a paper on the transformation of bromide of isobutyl into bromide of tertiary butyl under the influence of high temperatures. M. Beketoff, on behalf of himself and of M. Tscherny, communicates a note on the dissociation of sulphuretted, seleniuretted, and telluretted hydrogen; and, on behalf of M. Kousmensky, a note on the action of oxide of silver upon chloride, bromide, and iodide of lithium. M. Stcherbatscheff treats on the influence of the chloride of sodium on the dissociation of hydrated sulphate of soda in solution. M. Moun has examined the amount of coke yielded by three isomeric bodies—Swedish filter-paper, starch, and gum. The first, when submitted to destructive distillation, yields 6.73 per cent of carbonaceous residue; the second, 11.30; and the third, 20.4. M. Alexeeff gives a preliminary communication on the mutual solubility of liquids. The solubility of amylic alcohol in water decreases as the temperature increases, whilst the solubility of water in this alcohol augments under the same conditions. The second part contains an important investigation by M. Schöne on the peroxide of hydrogen contained in the atmosphere. M. Morkownikoff publishes a memoir on the oxidation-products of oxybutyric acid. M. N. Zalomanoff communicates experiments on a new method of determining the absorbent power of different soils. He proceeds by filtration, and concludes that the agitation method gives erroneous results. He cannot confirm Liebig's view that the drainage water represents the water in the soil. M. Beketoff publishes a note on the influence of the weight of elements on the reactions of substitution or double decomposition.

Progress of the Sulphuric Acid Manufacture in England.—M. G. Lunge.

No. 9, May 5, 1875.

Researches on the Carbon of White Cast-Iron.—MM. Schützenberger and A. Bourgeois.—Already noticed.

Unequal Action of Various Isomorphs on the Same Saturated Solution.—M. Lecoq de Boisbaubran.—Noticed elsewhere.

Substitution of Mercury for the Hydrogen of Creatin.—R. Engel.—Already noticed.

Stability of the Salts of the Fatty Acids in Presence of Water.—M. Berthelot.—Already noticed.

Les Mondes, Revue Hebdomadaire des Sciences.

No. 16, April 22, 1875.

This number contains no original chemical matter.

No. 17, April 29, 1875.

Electricity of Mineral Springs.—M. Thury.—Two platinum electrodes were plunged, the one in the great mineral spring of the Stadthof, and the other in the river Limmat. When connection was made the mineral water was found to be strongly electro-negative. If water was allowed to cool, and artificially re-heated, no current was produced.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 16, April, 1875.

This issue contains no chemical matter.

MISCELLANEOUS.

Organisation of the United States Board appointed to Test Iron, Steel, &c.—A Board has been appointed by the Government of the United States "to determine by actual tests the strength and value of iron, steel, and other metals which may be submitted to it, or by it procured, and to prepare tables which will exhibit the strength and value of said materials for constructive purposes." It has standing committees on abrasion and wear, on armour plate, on chemical research, on chains and wire ropes, on corrosion of metals, on the effects of temperature, on girders and columns, on metallic alloys, on physical phenomena, on steels produced by modern processes, &c. The constitution of this Board may be taken as an additional proof of the growing conviction how largely the power and the prosperity of nations depend on physical science.

Plattner's "Manual of Blowpipe Analysis."—Mr. D. Van Nostrand, the American publisher, writes:—I have just received from London what purports to be a translation of Plattner's "Blowpipe Analysis," which, upon examination, proves to be an exact reprint, word for word, of Prof. Cornwall's translation published by me. It is translated and edited, or purports to be, by T. Hugo Cookesley, and gives no credit to Prof. Cornwall, but merely says a translation has been published in New York, which he has followed to some extent. I have just issued the subjoined:—

NOTICE TO THE TRADE.—An English reprint of my edition of Plattner's "Manual of Qualitative and Quantitative Analysis with the Blowpipe" having appeared in London, I would hereby caution the trade against introducing the same into the United States, as under the copyright laws parties so doing would render themselves liable to legal damages, as well as to confiscation of all copies so imported and placed on the market. This English edition purports to be edited by one T. Hugo Cookesley, but with the exception of the omission of a few tables, and of some other matter of slight importance, it is a verbatim reprint of my edition, translated by Prof. H. B. Cornwall, of Princeton College. This "pirated" edition is published by Messrs. Chatto and Windus, of London.—D. VAN NOSTRAND, Publisher, New York, May 17.

The British Association Committee on Commercial Phosphates and Potash Salts.—No small amount of correspondence has appeared in our columns on the determination of phosphoric acid and on the discrepancies existing between the respective results of "high" and of "low" analysts. Our readers, doubtless, will be glad to find that steps are being taken towards the removal of a state of things discreditable to analytical chemistry and to its professors, and certainly injurious to an important and growing commerce. At the last meeting of the British Association, a committee, consisting of Messrs. E. Dewar, A. Fletcher, E. C. Stanford, and A. H. Allen, was appointed "for the purpose of examining and reporting upon the methods employed in the estimation of potash and phosphoric acid in commercial products, and on the mode of stating the results." Among other steps, the Committee have addressed a circular to all Fellows of the London Chemical Society, and, we hope, to other gentlemen engaged in, or conversant with, the analysis of manures, soliciting information. Among other questions, they ask—"Will you give the Committee the details of the process you habitually employ for the estimation of the phosphoric acid in commercial phosphates? What length of time does the process require? Are you of opinion that the method gives strictly accurate results? If not, will you state the direction in which the error occurs and its maximum extent?" If these and the succeeding questions meet with replies from experienced practitioners in this department, a body of most valuable information will be collected. After comparing the

answers, and bringing conflicting views, if such should appear, to an experimental test, the Committee will, we trust, be able to recommend for general adoption certain processes as suitable for different cases. Those chemists (if any) who feel unable to conform to such a decision will naturally be expected to state their "reason why." We hope that any of our readers who are in a position to throw any light upon this subject will communicate with the Secretary, Mr. A. H. Allen, No. 1, Surrey Street, Sheffield.

Programme de la Société Hollandaise des Sciences à Harlem, Année 1875.—We learn that the Council of the Society have made a donation of 2000 florins to the Netherlands Society for the encouragement of industry, to be applied in the purchase of objects for the Museum of Industrial Arts. The Société Hollandaise has also contributed towards the erection of monuments in honour of two of its foreign members, Elie de Beaumont and Quetelet, and to the foundation of a Leeuwenhoek medal, to be awarded decennially for the most important microscopic researches on inferior beings. The following subjects have been proposed for prizes:—*For January 1st, 1877.*—(1). Complete account of the development, structure, and manner of life of the Ophioglossæ, as compared with the other ferns. (2). A historical and critical study, based upon personal observations and experiments, on the influence which light exerts on the vernal growth of plants. (3). As boats descend a river more rapidly than the water in which they are plunged, the question arises, what influence this circumstance has upon the vertical floats employed to measure the speed of the current. (4). An exhaustive study of the causes to which the luminous phenomena of phosphorescent minerals are due. (5). The extent in the Netherlands of the fossiliferous stratum known as the Eemian system (of Harting), accompanied by a collection of its animal and vegetable fossils and an account of its relations with other known deposits. (6). A methodical study of the influence of stretched cords upon the acoustic properties of halls. *On January 1st, 1880.*—(7). What is the influence of the moon upon the position of the magnetic needle? Essays on the following subjects must be sent in by *January 1st, 1876*:—(8). Exact researches on the solvent power of water and of water charged with carbonic acid upon gypsum, limestone, and dolomite at various pressures and temperatures, and in the case of the simultaneous presence of common salt and of other soluble salts widely distributed in nature. (9). A similar set of researches upon silica and natural silicates. (10). A critical examination of researches on the peptones of different albumenoid matters completed by original investigations. (11). An exact determination, in Weber's units, of the resistance of a column of mercury of a metre in length and a square millimetre in section. (12). An experimental investigation of the relation between electromagnetic and electro-static unities. (13). New experiments on the influence of pressure upon chemical action. The memoirs may be drawn up in Dutch, French, Latin, English, Italian, or German, but must not be written in German characters—a very wise precaution. We cannot help remarking that we have little faith in the efficacy of prizes offered to stimulate research. It has been humourously said that you cannot bribe a barren hen to lay eggs. The rewards proposed should, at any rate, amount to a fair remuneration for the time that the required investigations must necessarily engross, but of this they fall lamentably short.

Paton and Harris's Pyroletor, for the Extinction of Fire on Board Ships.—Under the supervision of Dr. R. Carter Moffat, who conducted the experiments, a large party of gentlemen connected with shipping and the Board of Trade assembled at Greenhithe, near Gravesend, on Tuesday, to witness the power of the pyroletor to extinguish fire in closed places. The pyroletor consists of a small double pump worked by hand, which sucks up from tubes on either side of it strong muriatic acid and a solution of bicarbonate of soda, which commingle in a gene-

rator forming part of the pump, and the carbonic acid gas and solution of salt pass at once down a metal pipe to the hold, along whose keelson runs a perforated wooden box which admits of the gas passing through to the burning material. The agent, therefore, for the extinction of fire is dry carbonic acid gas, which has no action on cargo. A well-appointed steamer conveyed the party from Blackwall to Greenhithe, where a large wooden barge had been prepared for the experiments. Its entire hold was covered to a depth of several feet with wood shavings, cotton-waste saturated with turpentine, and naphtha. A temporarily-raised and by no means air-tight wooden deck, with loosely-fitting boards, formed the wide hatchway covering. After the apparatus had been explained by Dr. Moffat, its action as a common wash-deck-pump and fire-engine for fire above board had been observed, when it acted very efficiently, throwing water a distance of at least 30 feet, the pipes to the chemicals were attached, and the signal given to set fire to the inflammable materials in the hold. Immediately the flames ran along the entire cargo and issued above the temporary deck, which was then covered with boarding. The pyroletor having been brought into action, and although nearly half a gale of wind was blowing, the fire was completely extinguished in four minutes. The experiments were so completely successful, and the efficiency of the apparatus so apparent, that the party at once agreed to sign a memorial to ask Government to compel all long-passage ships conveying passengers and cargo to carry one of these instruments. It is computed that a 1200-ton ship requires about half-a-ton of each of the chemicals, which, with their packages, cost about £20

PATENTS.

ABRIDGMENTS OF PROVISIONAL AND COMPLETE SPECIFICATIONS.

A new method of producing heat. Carl Julius Tetens Hanssen, Chancery Lane, Middlesex. August 8, 1874.—No. 2749. Producing heat by burning gases containing hydrogen in carbonic acid gas at a high temperature, with a small addition of air or oxygen.

Improvements in and improved appliances and arrangement of apparatus for the manufacture and concentration of sulphuric acid. Auguste Ferdinand De Hemptinne, chemist, Molenbeek, Saint Jean, Brussels. August 14, 1874.—No. 2807. This invention describes a method of manufacturing and concentrating sulphuric acid by reducing the size of the leaden chambers ordinarily employed, but increasing their surfaces by filling them with stoneware vessels, by sprinkling these vessels with the acid in process of manufacture; also a modification of the Gay-Lussac tower for denitrification and concentration by superheated steam acting on porcelain vessels over which the acid is trickling, and kept away from contact with the walls of the chamber.

Improvements in treating metals and their alloys by subjecting them to the action of liquids, gases, vapours, and in apparatus employed therein, and for the manufacture of gas for illuminating and heating purposes. Wade Hampton Smith, civil engineer, Edgbaston, Birmingham, Warwick. August 15, 1874.—No. 2815. The inventor uses wood-naphtha, hydrocarbon, hydrochloric acid, nitrous acid, nitric acid, and iodine in a fluid state, and the gases and vapours resulting from any or all of the above liquid matters, carburetted hydrogen or coal-gas, nitrogen-gas, and atmospheric air in such proportions as may be required, combined or uncombined. In carrying out the improvements, each of the before-named fluids are placed in separate vessels or chambers; the contents of these respective chambers are capable of being conducted and are conducted together or separately into a passage through which a current of atmospheric air, gas, or vapour is caused to flow, so that the atmospheric air, gas, or vapour alone or combined with any or all of these liquids, gases, or vapours may be conducted in any required proportions to the cupolas, furnace, converter, or other suitable vessel containing the metal or metals to be acted upon, or to a receiver or gasometer for further use, or when required for illuminating and heating purposes. The principle adopted and the apparatus used for effecting the above are the same or similar to that well known for making ether sprays or other air spray jets. The gases or vapours are described in Specification of Letters Patent granted to the inventor and J. T. Kirkwood, dated February 18, 1874, may be used and applied to operate in like manner on the metals above mentioned and their alloys.

Improvements in the manufacture of light gases, and in the method of inflating balloons therewith (for military and other purposes), and in machinery and apparatus for such purposes, and for directing, guiding, propelling, and managing such balloons. Isham Baggs, practical chemist, High Holborn, Middlesex. August 15, 1874.—No. 2821. This invention consists, first, in the manufacture of light gases for the inflation of balloons, such gases being hydrogen gas obtained by the action of hydrochloric acid or sulphuric acid upon zinc; or the light gases produced by the combustion of wood, straw, or other materials, and in machinery and apparatus employed for such purposes

and, secondly, in machinery and apparatus consisting of wings and a tail, which can be placed at different angles and in different positions, so as to direct and control the movements of the balloon.

Improvements in the manufacture of cement. Granville Hamilton Forbes, Clerk in Holy Orders, Broughton Rectory, Northampton. August 15, 1874.—No. 2822. My present invention is an improvement upon the invention for which I made application for Letters Patent July 7, 1874.—No. 2374. According to the said former invention I intimately combine coke or its equivalent with chalk and clay with or without tar, for the purposes of manufacturing cement. According to my present invention I intimately combine coke, or coke-breeze, or an equivalent of the same, or coal or coal dust with chalk, or limestone, or quicklime, with or without tar for the purpose of manufacturing cement.

Improvements in the treatment of alizarin for the production of different colours or hues therefrom in dyeing and printing. Félix De Lalande, civil engineer, Rue d'Enfer, Paris. August 18, 1874.—No. 2841. This invention consists in treating alizarin with various oxidising agents in order to obtain therefrom colours or hues in dyeing and printing differing from those obtained from alizarin without such treatment. One method of operating consists in mixing together dried and pulverised alizarin, arsenic acid, and sulphuric acid in given proportions; heating the compound; and boiling the same with water, after which it is filtered and washed. In place of the arsenic acid, antimoniac acid, or peroxide of manganese, or stannic acid may be employed. According to another method dried pulverised alizarin is mixed with concentrated nitric acid, refrigerated by means of ice, and after a few minutes the mass is poured into cold water, and the precipitate is collected and washed. According to another method the alizarin suspended in water is treated with bichromate of potash or peroxide of lead, nitrate of copper, nitrate of mercury, mercurous nitrate, perchloride of iron, sulphate of peroxide of iron, or nitrate of peroxide of iron. According to another method alizarin-paste is mixed with sulphate of copper, chlorate of potash, and siliceous sand; the mixture is heated in a vapour-stove for several days, and is then treated with water to remove the soluble salts, and the colouring matter is extracted by caustic soda, and precipitated by an acid.

Improvements in the treatment or manufacture of cast-iron. George Gordon de Luna Byron, Chancery Lane, Middlesex. August 22, 1874.—No. 2883. This consists in alloying cast iron while in a molten state with copper, tin, zinc, manganese, and antimony. This flux is melted in a crucible, and mixed with iron, whereby the oxides, sulphur, and phosphorus are removed, and reducing the carbon therein.

Improved disinfecting or fumigating candles and pastiles. Frank Wirth, of the firm of Wirth and Co., Frankfort-on-the-Main, Germany. (A communication from William Ressig, Ph.D., Darmstadt, Germany.) August 22, 1874.—No. 2884. The object of this invention is to obtain candles and pastiles which when ignited give off a continuous current of sulphurous acid gas for disinfecting and fumigating purposes.

A new and improved process for the manufacture of sulphur-acids, and of sulphites, bisulphates, and sulphates. Alfred Payne, manufacturing chemist, Wolverhampton, Stafford. August 24, 1874.—No. 2893. The inventor burns sulphur or sulphur-ores in a close kiln, admitting only sufficient air for the proper combustion of the sulphur. He inserts one or more pipes into the crown of the kiln, which (after traversing suitable refrigerators) are attached to one or more force-pumps, by which the sulphurous acid fumes are drawn off from the kiln as fast as generated, and forced or projected through one or more outlet-pipes into the vessels containing the material to be operated upon. He produces sulphites and bisulphites directly in this way, and thus avoids the use of sulphuric acid in their production. The inventor produces sulphuric acid by oxidating liquid sulphurous acid (formed by injecting sulphurous fumes into water) by means of nitric acid or other suitable oxidating agents. The inventor produces sulphates by first forming sulphites by the before-mentioned process, and then oxidating by agitation with atmospheric air, or by means of other suitable oxidating agents.

An improved white metallic alloy. Louis Victor Léniau, merchant, Place de la Bourse, Paris. August 29, 1874.—No. 2954. This Provisional Specification describes a white alloy composed of copper, nickel, bismuth, zinc, malleable iron, and tin.

Improvements in the manufacture of sulphate of soda and of sulphate of potash. Arthur McDougall, manufacturing chemist, of the firm of McDougall Brothers, Manchester and London. September 2, 1874.—No. 3003. In the manufacture of sulphate of soda and of sulphate of potash by the direct action of sulphurous acid upon the chlorides of sodium and of potassium, great expense and trouble is caused by the usual process of moulting and breaking the moulder salt into lumps, so that when placed in the saturation-cylinders a free passage is allowed for sulphurous acid gas. My invention consists in maintaining the salt in motion whilst exposed to the action of the sulphurous acid gas by the use of suitable mechanical means, so that the salt may be employed in a loose state, and thus save the trouble and expense of preparing lumps, and also cause a more rapid completion of the decomposing action. I also introduce steam in a superheated state during the process; by this means a more rapid action takes place, and the necessary temperature is more easily kept up.

Improvements in apparatus for the manufacture of sulphate of soda and sulphate of potash. William Hunt, manufacturing chemist, Castleford, near Normanton, York. September 2, 1874.—No. 3005. This invention has reference to that process of manufacturing sulphate of soda and sulphate of potash, in which chloride of sodium or chloride of potassium is decomposed by a mixture of sulphurous acid gas, air, and steam; and the said invention consists in erecting the chambers in which the chloride is decomposed immediately over the pyrites burners. The hot gases from these burners pass out through the arches of the burners, and travel under and in contact with the floors of the chambers. By this invention the bottoms of the chambers are maintained at a high temperature, which is communicated to the

gaseous mixture as it circulates through the chambers, and the requisite high temperature is preserved.

Improvements in the manufacture of stearine, with the object of transforming oleines or oleic acids into crystalline substances, which may be employed either to make candles or soap, or for other purposes; and for extracting the solid matter that the oleic acids contain in solution, and thus to render them more limpid. William Morgan-Brown, of the firm of Brandon and Morgan-Brown, engineers and patent agents, Southampton Buildings, London. (A communication from Edward Bastie, chemist, Rue Gaillon, Paris.) September 3, 1874.—No. 3021. This invention describes a method of transforming oleine or oleic acids into elaidine or elaidic acid by putting these bodies in intimate contact with reagents which produce the reduction of any peroxide or any hydrogenic acid, with allotropic or nascent hydrogen, or any decomposition, chemical or electric, of water made by chlorine or other substances.

Improvements connected with the process of coating steel, iron, and cast-iron with gold, silver, and other metals or alloys. Jacob Baynes Thompson, Whitehall, Wraysbury, Bucks. September 4, 1874.—No. 3033. The invention consists in protecting the articles to be coated on their passage from the "cleaning-vat" to the "plating-vat" by applying thereto a thin film of aluminium or aluminium slightly alloyed.

NOTES AND QUERIES.

** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Magnesite and Bauxite.—Can any of your subscribers inform me where I can obtain magnesite and bauxite, as I wish to possess some of these materials?—S. E. G.

Fish Oils.—I desire practical directions for testing the purity of the most common fish oils. Can any of your readers kindly refer me to some publication where I may find such?—G. C.

Analysis of Sugar.—Could any of your readers inform me where I could see an account, in English, of Dr. C. Scheibler's new process for the valuation of raw sugar by the use of alcohol? By giving the above information they would greatly oblige.—J. W. M.

Phosphorescent Powders.—Will your readers kindly furnish me with answers to the following questions?—(1) What is the composition of the phosphorescent powders of various colours advertised in your columns? (2) What is the cause of the phosphorescence which these powders assume for a short time after their exposure to light? I am not aware that the powders are patented. They smell strongly of sulphur.—A. F. S.

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THE CHEMICAL NEWS.

VOL. XXXI. No. 813.

NOTE ON SOME CRYSTALLINE PRODUCTS OBTAINED FROM A BLOWN-OUT IRON FURNACE.

By GEORGE JOHNSTON, F.C.S.,
Student in the Yorkshire College of Science, Leeds.

ON recently blasting out, in the Middlesborough district, the mass of metal, slag, &c., which gradually collects beneath an iron furnace, and is technically known as the "dead-horse," a quantity of bright crystalline matter was found immediately below where the hearth had been when the furnace was in operation. The crystals belong to the octahedral system, are light grey in colour, and of various sizes, some of them being very large. It is almost certain that the mass of slag, &c., with which they were associated has been for ten or twelve years continuously at a temperature not much below that of the melting-point of cast-iron. They are apparently homogeneous, but may readily be separated under the pestle into a dark coloured, easily pulverised, and comparatively lustreless portion, and into little irregular masses, which are malleable, and when beaten out light coloured and highly lustrous. This malleable portion forms one-third of the larger crystals, and nearly two-fifths of the smaller. It is tolerably uniform in composition as the following analysis made on portions (No. 1, obtained from a large crystal of sp. gr. 5.48, and No. 2, from a small one, sp. gr. 4.89) will show:—

	No. 1.	No. 2.
Iron	95.69	94.48
Graphite	1.62	3.52
Combined carbon	0.94	0.10
Silicon	1.56	1.54
Phosphorus	0.18	0.36
Sulphur	0.21	0.10
Manganese	trace	none
	100.20	100.10

The composition of the easily pulverised portion of one crystal bears no relation to that of another. An analysis* of this portion of the above-mentioned crystals gave the following results:—

	No. 1.	No. 2.
Iron	82.66	65.59
Graphite	11.64	29.58
Combined carbon	2.89	1.43
Silicon	0.93	2.27
Phosphorus	0.27	0.68
Sulphur	0.18	0.39
Manganese	1.44	0.24
	100.01	100.18

The composition of the crystals as a whole calculated from the analysis of its two constituents is as follows:—

	No. 1.	No. 2.
Specific gravity	5.480	4.892
Iron	87.00	76.62
Graphite	8.30	19.62
Combined carbon	2.24	0.92
Silicon	1.14	1.99
Phosphorus	0.24	0.55
Sulphur	0.19	0.27
Manganese	0.96	0.14
	100.07	100.11

* The determinations of the carbon in these powders were made by Wöhler's method, that is, burning in a stream of oxygen; experiment showed that it was impossible to effect the complete oxidation of such large quantities of graphite by the chromic acid method.

Titanium was carefully tested for without obtaining any indication of its presence.

In addition to the crystals large quantities of a lustrous laminar substance were discovered in the "horse." This laminar mass contains a very high percentage of graphite and of silica; over 40 per cent graphite, and nearly 30 silica. The rest consists chiefly of a mixture of metallic iron, sulphide, and oxide, of which the oxide is much the larger constituent.

The production of these substances in the "dead-horse" from the original cast-iron which had found its way there from the furnace, may be explained by supposing that as this iron gradually cooled, the carbon has separated out in the form of graphite, ascended through the mass of metal, slag, &c., and thus become concentrated in the upper layers, much in the same manner as it is sometimes found on the surface of slowly cooled iron. The conditions existing in the "horse" would be greatly more favourable for such a separation than when the iron is exposed, owing to the extremely slow rate at which the mass cools. The highest part of the "horse" would, according to this view, contain the largest percentage of graphite, and as we descended this would become more and more mixed with iron, giving rise, indeed, to products similar to those now before us.

The octahedral character of the crystalline mass is evidently due to the iron, which, under the favourable conditions of a prolonged exposure to an intensely high temperature and a subsequent slow cooling, has assumed its normal crystalline form notwithstanding the large quantity of graphite with which it was mixed.

My thanks are due to Professor Thorpe, to whom the specimens were originally sent, for his advice and assistance; and to Dr. Parkinson of Bradford, from whom they were received, for information concerning the circumstances under which they were found.

REPORT

ON THE

DEVELOPMENT OF THE CHEMICAL ARTS DURING THE LAST TEN YEARS.*

By Dr. A. W. HOFMANN.

(Continued from page 264).

TH. GRAHAM, who, in his classical researches, investigated the laws of the escape of gases through narrow apertures, made known in 1866† that air which is drawn through a fine chink in a plate of caoutchouc passes in the constant proportion of 41.6 per cent of oxygen to 58.4 per cent of nitrogen, the half of the atmospheric nitrogen being held back. This mixture causes glowing chips of wood to burst into flame. Deville‡ tested the industrial value of this process, and found that the time required was too long.

Absorption has been utilised in two distinct forms. Montmagnon and De Laire in 1868 took out a French patent,|| based upon the observation of Angus Smith§ that charcoal absorbs from the air more oxygen than nitrogen. According to them, 100 litres of wood-charcoal absorb 925 litres of oxygen, and only 750 litres of nitrogen. If moistened with water, they give off 350 litres of oxygen and 650 litres of nitrogen, so that 575 litres of oxygen and 55 (100?) litres of nitrogen remain and can be extracted with the air-pump. By repeating this process with the same gaseous mixture, they succeeded in bringing the oxygen almost in a state of purity. Whether this process has ever been carried out on the large scale is not known. An attempt has, however, been made with Mallet's

* "Berichte über die Entwicklung der Chemischen Industrie Während des Letzten Jahrzehends."

† Graham, *Comptes Rendus*, lxiii., 471.

‡ Deville, Wagner, *Jahresberichte*, 1867, 216.

|| *Bull. de la Soc. Chim.* [2], xi., 261.

§ Angus Smith, *Proc. Roy. Soc.*, xii., 424.

method,* based on the property of water to absorb oxygen rather than nitrogen.

The coefficients of absorption of the two gases are 0.025 for N, and 0.046 for O. If multiplied by the proportion of their bulk in the atmosphere, 0.79 for N, and 0.21 for O, these numbers give the volume-proportion of both gases in water = 0.0197 N and 0.0097 O; or, the air absorbed in water contains, in one volume, 0.67 N and 0.33 O. If the unabsorbed nitrogen is allowed to escape, and the absorbed gaseous mixture, richer in oxygen, is withdrawn from the water and again absorbed, it follows, from the multiplication of the two coefficients of absorption with the volume proportions 0.67 N and 0.33 O, that the gaseous mixture now taken up has the composition 0.525 N : 0.475 O; a third absorption raises the result to 0.375 N : 0.625 O; a fourth to 0.25 N : 0.75 O; and a fifth to 0.15 N : 0.85 O, the proportion in which the two gases occur in Tessié du Motay's oxygenous mixture. After the eighth absorption, the gas is almost pure oxygen (0.973 O and 0.027 N).

Mallet's apparatus consisted of a larger or smaller number of strong iron water-holders connected with each other by means of suction- and forcing-pumps. Into the first air is driven through fine apertures at a pressure of about five atmospheres. The unabsorbed nitrogen escapes by a valve. The absorbed gas is now extracted by the second pump from the first receiver and forced into the second. With a series of four receivers the operation lasts five minutes. If the receivers serially decrease in size, the first holding 10 cubic metres and the last 5, the result of a continuous working of the process is 7760 litres per hour of a gaseous mixture containing 75 per cent of oxygen, or 168 cubic metres in twenty-four hours. The cost of working, wear and tear, and supervision are said to be insignificant. Where motive power is cheap, *i.e.*, water-power or the waste heat of metallurgical processes, this method may consequently be applicable, especially for use in such metallurgical operations where a mixture comparatively poor in oxygen is serviceable.

If we sum up the results of our survey of the methods for the industrial preparation of oxygen, we must place Tessié du Motay's process in the first line, as well tried and proved, and in the second Mallet's mechanical process as just described.

Finally, we pass to the question, To what applications has oxygen hitherto been put? As the supporter of combustion, we owe to it heat and light; and as the medium of respiration, it is the condition of life.

(To be continued.)

ANALYSIS OF MUD, TAKEN AT LOW WATER, FROM THE MER-ROUGE, MAURITIUS.

By C. J. H. WARDEN,
Surgeon, 26th Bengal Native Infantry.

ONE hundred parts of the soil dried at 242° F. contained—

Ferric oxide	..	..	..	..	..	25.634
Aluminic oxide	..	..	..	..	..	14.037
Calcic oxide	..	..	..	..	..	3.425
Magnesian oxide	..	..	..	..	..	1.353
Sodic oxide	..	..	..	..	..	0.627
Silicic anhydride	..	..	..	..	..	40.782
Phosphoric anhydride	..	..	..	..	..	0.893
Sulphuric anhydride	..	..	..	..	..	0.362
Carbonic anhydride	..	..	..	..	..	2.526
Chlorine	..	..	..	..	..	0.968
Organic matter	..	..	..	..	..	9.711

100.318

Malarious fevers have been attributed to the emanations from this soil. The amount of ferric oxide is large, but otherwise there is nothing peculiar in its chemical composition.

* Mallet, *Dingler's Polyt. Journ.*, *cic.*, 112.

ON THE ESTIMATION OF PHOSPHORIC ACID AS AMMONIO-MAGNESIAN PHOSPHATE.

By THOMAS ROBERTSON OGILVIE.

ALTHOUGH this process is one of the most important and most frequently used methods in the whole field of analysis, a very considerable number of directly contradictory statements regarding the precautions to be observed in its manipulation have been published during the last few years by chemists in this country and elsewhere. For instance, several authorities state that the precipitation of the ammonio-magnesian phosphate should take place in a cold solution. Watts, in his "Dictionary," says (vol. iv., p. 543), "Care must be taken not to allow the liquid to become very hot, as in that case hydrate of magnesium will be precipitated, and will be very difficult to re-dissolve." Schumann, quite recently (*J. pr. Chem.* [2], vi., 416), makes a similar statement; and Brunner (*Zeitschr. Anal. Chem.*, xi., 30—32) gives the results of two analyses of a bone-ash, showing that the one done at 60—70° C. was 1.25 per cent of P_2O_5 higher than the other done at 20° C. On the other hand, Parnell (*CHEM. NEWS*, vol. xxiii., p. 145) recommends precipitation in a warm solution: he says—"In order to insure the purity of the precipitate I now raise the two ammoniacal solutions to the boiling-point; on mixing them and stirring, a bright crystalline precipitate appears, which so far has never failed to be pure." Munroe also (*CHEM. NEWS*, vol. xxiv., p. 32) prescribes the same means as a precaution by which to get a precipitate of the greatest purity.

Another matter on which differences of views exist is the influence of citric acid. In a valuable paper written by Fresenius, Bauer, and Luck (*Zeit. f. Anal. Chem.*, vol. x., p. 133), the statement is made that magnesium citrate is often precipitated with the phosphate, while Warrington, who originally proposed the adoption of citric acid instead of tartaric acid, asserts (*Journal of the Chemical Society*, vol. x., p. 326) that he "never obtained any precipitate by treating magnesia mixture with citric acid, though varied conditions have been tried." Again, Fresenius and others give as a process for the estimation of phosphoric acid in combination with alumina, the addition of sufficient citric acid to hold up the oxide and the precipitation of the acid as ammonio-magnesian phosphate. Well, the explicit statement is made by Knap (*Zeitsch. f. Chemie*, vol. ii., p. 157) that he found the presence of alumina rendered the estimation of phosphoric acid impossible by this process, as, even after allowing the solution to stand for some time, no precipitate was found.

A further point of dispute is the value of re-dissolving and re-precipitating the precipitate as a means of freeing it from impurity. In the text-books this precaution is recommended: and recently Kubel (*Zeit. f. Anal. Chem.*, vol. viii., p. 125) asserted that as the weight of the pyrophosphate is invariably too high, the ammonio-magnesian phosphate should be re-dissolved and re-precipitated at least once. Heintz says (*Zeit. f. Anal. Chem.*, vol. ix., p. 16) the error arising from the co-precipitation of magnesium hydrate or of neutral or basic magnesium sulphate can be corrected by once more re-dissolving and re-precipitating. On the other hand, Schumann (*J. pr. Chem.* [2], vol. vi., p. 416) considers it unnecessary to re-precipitate if the addition of a great excess of magnesia solution is avoided; while Parnell (*CHEM. NEWS*, vol. xxiii., p. 145) states that he sometimes found the ignited precipitate to contain an excess of magnesia to the extent of 8 per cent, and in such cases re-solution in hydrochloric acid and re-precipitation with ammonia failed to give a pure precipitate.

I might go on to quote further conflicting statements regarding the other details of this process, but I think I have brought forward sufficient to show that there is great necessity for investigation as to the exact and specific

modus operandi that should be observed in its manipulation. And need we be astonished at the discrepancies in the commercial analyses of phosphates—many of which are done by this method—in the face of such great disparity in the views and results arising from scientific investigations? These discrepancies are proverbial, and the efforts of some of the dealers in phosphatic materials to get agreeing results from different analysts would be amusing were they not so suggestive of irritation to the merchants and of discredit to the analysts.

The following are the details of a series of experiments that were made with the intention of gaining some knowledge of the influence of certain reagents on the purity of the ammonio-magnesian phosphate, and also with the hope of ascertaining the best conditions otherwise under which this process should be performed:—

The “magnesia-mixture” employed contained in 1 c.c.—

0.0613 grm. magnesium chloride;
0.1401 „ ammonium chloride;
0.0191 „ ammonia (NH₃).

The solution in which the phosphoric acid was estimated was one of hydro-disodic phosphate, containing 0.2021 P₂O₅ in 50 c.c., equal to 0.3160 pyrophosphate of magnesia. 4.42 c.c. of the “magnesia-mixture” therefore precipitated exactly this quantity of phosphoric acid:—

- 5 c.c. allowed an excess of about 14 per cent of magnesia;
- 7 c.c. allowed an excess of about 50 per cent of magnesia;
- 13.5 c.c. fully twice more than necessary; and
- 20 c.c. three and a half times more than necessary.

All the precipitations were made at the ordinary temperature (unless when otherwise specified) and in solutions of about 100 c.c. in volume. Six hours were allowed for each precipitation. The reagents were free from all impurity, and the ammonio-magnesian phosphate was in each case washed until no chlorine was found in the filtrate with nitric acid and argentic nitrate. The precipitate was dried at 100° C., carefully separated from the filter-paper, the filter-paper placed in a porcelain crucible and thoroughly incinerated, then the precipitate also transferred to the same, slowly heated over an argand to drive off water of hydration and ammonium hydrate, and then placed over a Bunsen and ignited till of constant weight. The results are given as pyrophosphate of magnesia; the quantity which should have been got in each experiment was 0.3160 grm.

A.—Precipitation of P₂O₅ in Presence of Varying Proportions of Magnesia-Mixture.

No. of Expt.	Mg. Mix.	(a)	(b)
		2MgO, P ₂ O ₅ .	2MgO, P ₂ O ₅ .
1	5 c.c.	0.3160 grm.	0.3160 grm.
2	7 „	0.3150 „	0.3200 „
3	13.5 „	0.3190 „	0.3335 „
4	20 „	0.3220 „	0.3280 „

In (a) the “magnesia-mixture” just described, and which contained the base as chloride, was employed; in (b) the mixture contained the same proportion of magnesia as that used in (a), but in the form of sulphate. In 1 and 2 (a) the theoretical result was obtained, although in the latter an excess of 50 per cent of magnesia was present. In 1 of (b) the same result was obtained, while in all the others high results were got, owing to the precipitation of a magnesium compound other than the phosphate. I have not tried if the addition of a proportionately increased quantity of ammonium chloride would give purer precipitates. I believe it would. These details indicate, however, that the best results are obtained when the mixture contains the magnesia as chloride, and when not more than 50 per cent of an excess is added,

B.—Precipitation of P₂O₅ in Presence of Varying Quantities of Ammonium Chloride and of Magnesia-Mixture.

No. of Expt.	NH ₄ Cl.	Mg. Mix. = 5 c.c.		Mg. Mix. = 7 c.c.	
		2MgO, P ₂ O ₅		2MgO, P ₂ O ₅	
1	0.25 grm.	0.3155	0.3155	0.3160	0.3160
2	0.50 „	0.3150	0.3150	0.3150	0.3150
3	1.00 „	0.3150	0.3150	0.3160	0.3160
4	1.50 „	0.3150	0.3150	0.3150	0.3150
5	2.00 „	0.3150	0.3150	0.3140	0.3140
6	2.50 „	0.3155	0.3155	0.3140	0.3140

By the use of hydrochloric acid in dissolving a superphosphate or a mineral phosphate, a certain proportion of ammonium chloride is introduced into the solution in which the P₂O₅ is precipitated; but these experiments show that this salt has practically no influence, at least if present in only moderate quantity.

(To be continued).

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

June 17, 1875.

Professor ABEL, F.R.S., President, in the Chair.

AFTER the names of the visitors had been announced, and the minutes of the previous meeting read and confirmed, Messrs. R. E. Cumington, C. T. Blanshard, H. H. Hastings, and R. Stellan were formally admitted Fellows of the Society. The names read for the first time were those of Messrs. J. A. P. Price, B.A., A. S. T. McDonald, A. M. Graham, and W. Davis. For the third time—Messrs. Ludwik Bernstein, George Williams Wigner, John Macdonald Cameron, George Archbold, and Ralph Waldo Emerson MacIvor, who were balloted for and duly elected.

Mr. R. WARINGTON gave a short summary of his elaborate and valuable “Notes on the Chemistry of Tartaric and Citric Acids.” After touching on the preparation of the standard acids and alkalies and the extremely delicate litmus-paper employed in the titrations, he stated that he had found that the crystallised citric acid, as prepared in Mr. Lawes’s manufactory, invariably contained one molecule of water which it lost in the water-bath, but not always *in vacuo* over sulphuric acid, for, strange to say, he had noticed that, in some instances, the acid did not lose weight under these circumstances. Citric acid was now made almost entirely from lemon-juice prepared from the windfalls and imperfect fruit. In its unconcentrated state it contained 8—9 ozs. of acid per gallon, whilst that expressed from the fruit imported into England contained 10½—12½ ozs. There was usually about 64 ozs. of free citric acid per gallon in the concentrated juice and 6 or 7 combined with bases; of the total acid about 8 per cent was not citric acid. Details were given of the methods of analysis employed for the estimation in the citric acid liquor of the free sulphuric acid, the total organic acids, and the actual citric acid. In treating of tartaric acid the author, after noticing the fact that tartaric acid can never be fused without the production of ditartaric acid, and the effects of various salts and acids on the solubility of potassium bitartrate, explained what “lees,” argol, and tartar were. The lees which are deposited at the bottom of the cask vary in the amount of tartaric acid which they contain in the state of potassium bitartrate and of calcium tartrate, the latter being very large in proportion to the former in those countries, such as Spain and France, where it is the custom to add plaster to the grape juice before fermentation, whilst in Italian lees, where plaster is not used, the tartaric acid exists chiefly as the acid potassium salt. The beneficial effect of the addition of native plaster, which contains calcium

carbonate, in reducing the acidity is due to the fact that calcium tartrate is precipitated, and a solution of neutral potassium sulphate produced in which potassium bitartrate is very slightly soluble. Argol is the impure potassium bitartrate deposited on the sides of the cask, whilst tartars, some of which contain as much as 76 per cent of tartaric acid, are manufactured from the argol by extraction with hot water and crystallisation. He had found that the indirect methods of estimating the amount of tartaric acid in these substances by determining the potash, lime, and sulphuric acid present, and calculating the tartaric acid as acid potassium tartrate, and neutral calcium tartrate, were open to grave objections, since the sulphuric acid present might exist either as potassium or calcium salt. These objections applied with still greater force to the analysis of lees. It was necessary, therefore, to devise a method for determining the amount of tartaric acid directly. This was effected by adding a slight excess of potassium oxalate, neutralising with potash and separating the calcium oxalate precipitate. To the filtrate, which now contains all the tartaric acid as neutral potassium tartrate, citric acid is added in excess; this precipitates the tartaric acid as acid potassium tartrate, which is collected and weighed, a correction being made for that remaining in solution. It is a curious fact that, although pure citric acid can be neutralised by chalk, concentrated lime-juice cannot. This seems to be owing to the phosphoric acid and iron present in the latter, as it was found to be impossible to neutralise a solution containing iron, citric acid, and phosphoric acid even by protracted boiling with chalk.

The SECRETARY then read a paper "*On the Action of Nitric Acid on Copper, Mercury, &c., especially in the Presence of Metallic Nitrates*," by Mr. J. J. ACKWORTH. The results of the interesting experiments made by the author show that the action of cold dilute nitric acid on copper gives rise chiefly to nitric oxide, whilst nitric acid in the presence of a strong solution of cupric nitrate, yields nearly pure nitric oxide. With nitrate of ammonium and nitric acid, a mixture of nitrogen and nitrous oxide is evolved with varying amounts of nitric oxide. Nitrogen is chiefly produced by the action of nitric acid on zinc or iron in the presence of ammoniac nitrate, and with mercury the result is similar, but the action is very sluggish. When silver is treated with the acid, the gases consist principally of nitric oxide and nitrogen, with mere traces of nitrous oxide, whilst, if ammoniac nitrate be present, the proportion of nitrogen is very largely increased.

Dr. J. H. GLADSTONE then gave a short account of the "*Decomposition of Water by the Joint Action of Aluminium, and Aluminium Iodide, Bromide, and Chloride, Including Instances of Reverse Action*," by himself and Mr. A. TRIBE. In order to throw some light, if possible, on the iodo-ethylate of zinc obtained in former reactions, the authors added iodine to aluminium foil and water. A large quantity of gas was evolved, which, on examination, was found to be hydrogen, the residue in the flask being aluminic oxide and iodide. This seemed to indicate that the decomposition of the water was effected by a series of decompositions and recompositions resulting from the joint action of the aluminium and the aluminium iodide, a supposition confirmed by the results obtained by the action of aluminium with hydriodic acid, and with aluminium iodide. A similar result was obtained with metallic zinc and aluminium iodide, but the action was more sluggish. The aluminium iodide may be replaced by the bromide as chloride.

"*On Nitrosyl Bromide and on Sulphur Bromide*," by Mr. M. M. P. MUIR. The author found that on passing nitric oxide to saturation into bromine at the ordinary temperature, a compound was obtained having the formula NOBr_3 , the amount of nitric oxide absorbed not being sensibly affected by the pressure. This compound is readily decomposed by heat. On adding sulphur to bromine in the proportion 32 : 80, and agitating, the sulphur dissolves with development of a considerable

amount of heat, forming a ruby red liquid, which has an odour resembling that of sulphur chloride. On submitting it to fractional distillation and analysing the portion boiling between 190° and 200° , it was found approximately to have the composition S_2Br_2 . The author did not succeed in obtaining any other definite compound of bromine and sulphur.

"*On Achromatite, a New Molybdo-arsenate of Lead from Mexico*," by Professor J. W. MALLET. This substance, which was put into the author's hands as a silver ore from the mine of Guanaceré, was found on analysis to contain no silver, but to be a molybdo-arsenate of lead approximating to the formula



with an admixture of finely divided ferric oxide. The author gives detailed accounts of the analysis of it, and his reasons for believing it to be a distinct mineral and not merely a mixture of arseniate and molybdate of lead.

"*On Certain New Reactions of Tungsten*," also by Professor MALLET. The author finds, contrary to the statements in most manuals, that the precipitate produced by hydrochloric acid in the solution of an alkaline tungstate is to a great extent soluble in excess of the concentrated acid, and if zinc in fragments be gradually added to this solution, various colours will be produced, notably a magenta red, whilst a rich green is obtained if potassium sulphocyanate be added before the introduction of the zinc. If a mixture of an alkaline tungstate with a sulphocyanate in dilute solution be acidified with hydrochloric acid, and metallic zinc added, the liquid assumes a fine amethyst colour. The blue colour, well known as characteristic of one of the lower oxides of tungsten, may be most conveniently developed by the use of hyposulphurous acid (H_2SO_2) as the reducing agent. Details are given of the best methods of producing the phenomena just mentioned.

"*On the Action of Chlorine on Acetamide*," by Dr. E. W. PREVOST. The action of chlorine on acetamide, $\text{C}_2\text{H}_3\text{O.NH}_2$, was tried with the expectation that the NH_2 group would be removed and acetyl chloride, $\text{C}_2\text{H}_3\text{OCl}$, produced. It was found, however, that chlorine had no action in the cold, but when heated, the gas was absorbed and two crystalline substances produced, one of which is insoluble in ether and has a formula $\text{C}_4\text{H}_{11}\text{N}_2\text{O}_2\text{Cl}$, and the other, which is soluble, approximates to the formula $\text{C}_4\text{H}_8\text{NO}_2\text{Cl}$. There is little doubt but that the former is acetamide hydrochloride, $(\text{C}_2\text{H}_3\text{ONH}_2)_2\text{HCl}$.

Owing to the number and length of the papers read there was unfortunately no time for discussion at this meeting, the last of the session. The Society will not meet again until November next.

Prizes for Inventions.—The Prussian Government offers a prize of 3000 marks for a process which will give plaster casts the power of resisting periodically repeated washings, without in the least injuring the delicacy of the form or the tint of the material. A prize of 10,000 marks is also offered for a material for making casts of works of art, which shall possess all the good properties of plaster, but which, without any special preparation, will not deteriorate by periodically repeated washings. Competitors are to send with their consignments sealed envelopes bearing mottoes, and containing the names of the senders. On the *outside* of these envelopes is also to be written an address, to which the returned samples or any communications are to be sent. The samples which fulfil the requirements will become the property of the Prussian Government, and the names of the successful competitors will be published. The remaining samples will be returned to the addresses given on the envelopes. Competitors are to send in their samples to the "Königl. Preussisches Ministerium der Geistlichen, Unterrichts- und Medicinal-Angelegenheiten," not later than Dec. 31, 1875.

SOCIETY OF PUBLIC ANALYSTS.

At the meeting on June 2nd the following paper was read:—

ON THE ADULTERATIONS AND IMPURITIES OF TARTARIC AND CITRIC ACIDS.

By ALFRED H. ALLEN.

ALTHOUGH the nature of the ordinary impurities contained in these acids is well known, and most books on analysis profess to give methods for their detection, I have found some of the processes very unreliable, and others to require special precautions not always observed. In the following paper I have collected various data, and give the results of my experience with the hope that they may be found of value.

The principal accidental impurities of tartaric and citric acids are salts of potassium and calcium, together with iron, lead, and copper derived from the vessels used for the evaporation or crystallisation of the acid liquids. The presence of all these impurities is indicated by the proportion of ash left on igniting the specimen.

A number of samples of commercial tartaric and citric acids recently examined gave an amount of ash varying from 0.05 to 0.25 per cent.

The ignition is readily effected in a porcelain crucible over a Bunsen burner. Platinum vessels should be avoided, lest lead should be present: 5 or 10 grms. should be taken for the ignition. When the proportion of ash is small, it is of no interest to examine it further except for poisonous metals. Very sensible quantities of lead and copper are sometimes present. Of course their existence will be readily indicated on dissolving the ash in a few drops of nitric acid, diluting largely, and passing sulphuretted hydrogen.

A very fair approximative estimation of the lead or copper present may be obtained by placing the solution of the ash in a tall glass cylinder, and comparing the depth of tint produced by sulphuretted hydrogen with the tint obtained by treating an equal bulk of a very weak standard solution of lead or copper in a similar manner. The plan is identical with that recommended by Wanklyn for estimating the lead in water, except that sulphuretted hydrogen is substituted for ammonium sulphide. Experience has shown this to be necessary, owing to the frequent presence of iron, which, of course, gives a dark colour in an alkaline solution. I lay some little stress on this well-known fact, as I have recently examined some samples of aerated water which gave a deep brown colouration with ammonium sulphide, apparently indicating the presence of poisonous quantities of lead, but which further inquiry proved to be merely due to a considerable quantity of iron.

I prefer to examine the *ash* for poisonous metals instead of using the original sample of acid. The presence of copper is indicated on treatment of the ash with nitric acid in the crucible by the production of a blue colour.

Of course the presence of poisonous metals in tartaric and citric acids is always accidental, but as they are occasionally present in dangerous amount, it behoves the manufacturers to take every precaution to avoid their introduction, as the product containing them must be regarded as adulterated.

Many samples of citric acid contain free sulphuric acid, which may be known by the highly deliquescent character of the crystals. In testing citric acid for sulphates with chloride of barium, it is desirable to acidify rather strongly with hydrochloric acid.

The most common adulterant of citric acid, and almost the only substance purposely mixed with it, is tartaric acid, which is frequently found in the powdered samples sold in the shops. Many plans of detecting tartaric acid in admixture with citric acid have been proposed, but some seem to have been tried merely on the separate acids, and not on mixtures containing a comparatively small proportion of tartaric acid.

The ordinary method described in the text-books, of precipitating the tartaric acid from a cold neutral solution by addition of calcium chloride, I have found far from delicate, 10 per cent of tartaric acid in a sample escaping certain detection.

Messrs. Chapman and Smith found that a citrate, when boiled with a very alkaline solution of potassium permanganate (such as is used for the estimation of albumenoid ammonia), merely gave a green solution of alkaline manganate; but a tartrate, when similarly treated, caused a precipitation of brown manganese dioxide. I have been unable to verify these results, having failed to find any decided difference in the behaviour of the two acids.

Another proposed method of detecting this adulterant is to add excess of precipitated ferric hydrate to the aqueous solution of the sample, and to raise the liquid slowly to the boiling-point. The undissolved portion is allowed to settle, and the clear liquid is decanted off and evaporated to a syrup at a steam-heat. If tartaric acid is present, even in very small proportion, it is said to cause the deposition of a pulverulent precipitate of ferric tartrate, while the liquid obtained from pure citric acid remains clear. I have been unable to detect moderate percentages of tartaric acid by this test.

The best test for detecting an admixture of tartaric acid is the well-known one of a salt of potassium. It is remarkable how very few of the ordinary works on analysis make any mention of the precautions necessary for the successful detection of tartrates or potassium by their mutual reaction. If aqueous tartaric acid be added to a strong solution of the chloride or nitrate of potassium, a precipitate of the acid tartrate will often occur, but its formation is greatly impeded by the mineral acid set free. This may be proved by filtering off the liquid and treating it with a strong solution of sodium acetate, when a copious additional precipitation takes place, owing to the replacement of the free hydrochloric or nitric acid by acetic acid, and the insolubility of the acid potassium tartrate in the latter. Of course, the same object is attained by using excess of acetate of potassium as the precipitant instead of the nitrate or chloride. The precipitation is greatly promoted by stirring, the precipitation forming well-defined and characteristic streaks in the track of the glass rod. Of course the liquid must be quite cold. The delicacy of the reaction is greatly increased by the addition of alcohol.

A recognition of this fact suggested the possibility of rendering the test quantitative and delicate by using alcoholic instead of aqueous solutions of the sample and reagent. Tartaric and citric acids are both soluble in absolute alcohol, but the potassium salts are insoluble. Acid tartrate of potassium is also practically insoluble in proof spirit, while the citrates of potassium are pretty readily soluble in weak alcohol. In the following experiments I employed a proof spirit made by diluting ordinary methylated spirit with water till it had a density of 920:—

Some pure potassium-hydrogen tartrate was prepared, and its solubility in proof spirit at 16° C. proved to be 0.05 per cent, or 1 gm. in 2000 c.c. of spirit.

A saturated cold solution of potassium acetate in proof spirit was prepared. 100 c.c. contained about 36 grms. of the salt, so that 5 c.c. suffice for the precipitation of nearly 3 grms. of tartaric acid.

A series of samples of citric acid were prepared, containing from 5 to 50 per cent of tartaric acid.

Quantities of 2 grms. of each of these adulterated samples were dissolved in 20 c.c. of proof spirit, 5 c.c. of the saturated spirituous solution of potassium acetate was added, and the solution stirred and left over night. It was then filtered, the precipitate was washed with proof spirit saturated with acid potassium tartrate, and then once with ordinary proof spirit. The precipitate was then washed off the filter with hot water into a light porcelain dish, the water evaporated off at a steam heat, and the dry KHT weighed and calculated into tartaric acid.

It was hoped that, by proceeding in this manner, very accurate estimations of tartaric acid could be made, as there could be no loss except from the slight solubility of the precipitate in the solution, for which a correction could readily be made on the assumption that the citric acid and potassium acetate present had no influence on the solubility of potassium-hydrogen tartrate in proof spirit. To my surprise, however, the results obtained, even without the correction for solubility, showed sensibly more tartaric acid than had been actually added to the sample. A fresh series of experiments was made, exactly the same method being employed, except that the 2 grms. of the samples were dissolved in 40 c.c. of proof spirit instead of 20 c.c. as before, thus making the volume of the solution 45 c.c. By thus proceeding I obtained the following results, without the correction for solubility, which would make the numbers 1.1 per cent higher still :—

Tartaric Acid Added.	Tartaric Acid Found.	
	By Precipitation.	By Alkalinity of Ash.
No. 1 10	10.55	9.70
No. 2 20	20.70	20.40
No. 3 30	33.35	35.50
No. 4 40	43.50	42.25

In this series of experiments, the results were checked by igniting the precipitate and titrating the ash with standard acid. It was found that the carbon left retained alkali tenaciously, and, after dissolving the ash in water, it was necessary to ignite the black residue and then add its ash to the main quantity. In the above cases, the amounts of potassium carbonate found by the titration of the ash correspond to the percentages of tartaric acid shown in the last column of the table.

A convenient plan of estimating the tartaric acid volumetrically is to dissolve the precipitate in hot water and titrate the solution volumetrically. This plan gives results closely according with those obtained by direct weighing when pure tartaric acid is employed.

Another series of experiments was conducted in an exactly similar manner, except that the precipitate was washed with proof spirit which had *not* been previously saturated with acid potassium tartrate. The following results were obtained, no correction being made for solubility of the precipitate in the mother-liquor :—

Tartaric Acid Added.	Tartaric Acid Found.		
	By Weight of Precipitate.	Means.	By Alkalinity of Ash.
No. 1 10	10.00	10.04	10.50
„ 1A 10	10.25		10.10
„ 1B 10	9.88		—
„ 2 20	20.90	21.30	22.02
„ 2A 20	21.71		—
„ 3 30	31.50	30.73	31.59
„ 3A 30	29.96		—
„ 4 40	43.10	43.91	43.57
„ 4A 40	44.71		—

These estimations were very satisfactory when the proportion of tartaric acid did not exceed 20 or 30 per cent, but there was a uniform tendency towards too high a result. The discrepancies observed seemed attributable to—(1) The presence of tartaric acid in the sample of citric acid employed; (2) precipitation of an acid citrate together with the potassium-hydrogen tartrate.

Apart from direct experiment having proved the absence of tartaric acid in the original citric acid used, the invalid nature of the first explanation is shown by the fact that the *less* citric acid used the *greater* was the excess of tartaric acid found over that added.

Experiments were then made with the view of ascertaining whether the discrepancy was due to the second cause.

A quantity (2 grms.) of the citric acid was treated

in exactly the usual manner, and gave no evidence of the presence of tartaric acid. On the following morning the liquid was again stirred, the temperature being only about 8° C., when well-defined streaks were produced in the track of the glass rod, and in a few minutes the liquid became semi-solid from the formation of a crystalline precipitate. Either the sample was largely contaminated with tartaric acid, or the cold had induced the separation of potassium citrate. The latter, as might be expected, proved to be the truth, warming causing the precipitate to disappear gradually, while, on decanting off the alcoholic liquid and adding a moderate quantity of cold water, the precipitate dissolved instantly. The fact deserves special attention, as an ignorance of it might readily lead to a sample of citric acid being condemned as largely adulterated with tartaric acid, when the latter substance was entirely absent.

The above observation naturally gave the clue to the anomalous results already obtained. In the concentrated and highly alcoholic solutions used there was a tendency to the precipitation of potassium citrate along with the tartrate. This tendency seemed capable of correction by treating the washed precipitate with a cold saturated aqueous solution of potassium-hydrogen tartrate, which would readily dissolve any precipitated citrate without acting on the acid tartrate. The following experiments show the result of this treatment :—

Tartaric Acid Added.	Tartaric Acid Found.	
	Precipitate Washed with Proof Spirit.	Same Precipitate after treatment with Aqueous KHT Solution.
	Per cent.	Per cent.
No. 1.. .. 20	21.00	20.96
No. 2.. .. 40	44.60	38.77

In this case the results obtained from the sample containing 20 per cent of tartaric acid were almost within the limits of error, while the reduction of the weight of the precipitate in No. 2 by an amount equal to nearly 6 per cent of tartaric acid conclusively shows that the previous excess was due to citrate carried down by the tartrate precipitate. If, to the result obtained in No. 2, we add 1.1 per cent, as correction for solubility of the KHT in the mother-liquor, we obtain 39.87 per cent of tartaric acid found, as against 40 per cent added.

An attempt was next made to obtain a precipitation in an *aqueous* solution, using proof spirit merely for washing the product. Two quantities dissolved in ten times their weight of water gave by this method 35.15 and 16.85 per cent of tartaric acid respectively, instead of 40 per cent and 20 per cent added.

I next made some experiments in which a cold saturated aqueous solution of potassium-hydrogen tartrate was used as the solvent of the sample, but the results were unsatisfactory.

The results of the whole of the above experiments have led to the use of the following process, which, while readily detecting 2 or 3 per cent of tartaric acid, allows of the estimation of larger proportions with very fair accuracy :—

Dissolve 2 grms. of the sample to be tested in 45 c.c. of proof spirit, filter from any undissolved calcium or potassium tartrate, add 5 c.c. of a cold saturated solution of potassium acetate in proof spirit, stir, and allow to stand for twelve hours. Filter off the precipitate produced and wash it with proof spirit. Rinse off the precipitate from the filter with a saturated solution of potassium-hydrogen tartrate in cold water, digest in the cold for a few hours with occasional stirring, then filter, wash once with proof spirit, rinse off the precipitate into a small porcelain dish with boiling water, evaporate at 100° C., and weigh the acid potassium tartrate obtained. The weight, multiplied by 0.798 (or, roughly, 0.8), gives the quantity of tartaric acid in 2 grms. of the sample examined. As a check, the dry precipitate may be

ignited and the solution of the ash titrated with standard acid; or the same method (substituting standard alkali for acid) may be applied to the purified precipitate on the filter, so as to avoid the trouble of the subsequent evaporation at a steam heat.

Since the above experiments were made, I have found that a closely analogous method has been described by E. Fleischer; but, by strictly following his directions, I found that a precipitate was obtained containing a considerable admixture of citrate.

If any doubt whatever exists as to the precipitate produced by potassium acetate being really the acid tartrate, its insolubility in cold water will readily settle the question, but positive proof is readily obtained by the silver test, which is extremely delicate when carefully applied, but remarkably liable to failure if the proper conditions are not carefully observed. The following plan of operation gives very good results:—

A small quantity of the precipitate of acid potassium tartrate is washed with a little cold water, and then treated with a slight excess of ammonia. The resultant solution is boiled till neutral, allowed to cool, and then precipitated with *excess* of argentic nitrate. To the liquid containing the precipitate dilute ammonia is added till the precipitate has almost disappeared, when the solution is filtered. On heating the filtrate nearly to boiling for a few minutes, a brilliant mirror of metallic silver is produced on the sides of the tube. Citric acid does not reduce silver under similar circumstances, except on continued boiling.

After the precipitation of the tartaric acid in a solution by addition of potassium acetate, the citric acid may readily be detected in the filtrate (after evaporating off the alcohol) by applying the ordinary tests.

Muter's "Chemistry" contains a method of separating tartaric and citric acids by converting them into calcium salts and treating the precipitate with a perfectly neutral solution of cupric chloride, when calcium chloride is produced, together with soluble cupric citrate, while cupric tartrate remains insoluble. I have had no experience of this process, but it looks very promising, especially for the examination of citrates supposed to contain tartrates.

Mr. Wigner has suggested that the power possessed by solutions of tartaric acid of altering the plane of polarisation of a transmitted beam of light, would enable an accurate estimation of that acid to be made in the presence of citric acid, which is inactive. The method would evidently give a practised observer very good results in cases in which the adulterant was all *dextro*-tartaric acid, but would fail if the sample contained racemic, *laevo*-tartaric, or inactive tartaric acid. This objection does not apply to the estimation as a potassium salt.

Oxalic acid is said to be sometimes employed as an adulterant of citric acid. This dangerous admixture would, of course be readily detected by treating the aqueous solution of the sample with excess of ammonia, acidifying with acetic acid, filtering from any precipitated acid-ammonium tartrate, and testing the filtrate with calcium sulphate.

In conclusion, I desire to express my thanks to Mr. Wm. Galbraith, who has performed most of the manipulations described.

NOTE ON DR. CAMPBELL BROWN'S RECENT PAPER ON MILK.

To the Editor of the Chemical News.

SIR,—There was some discussion on Dr. Brown's paper which was read at the Society of Public Analysts, and appeared in last week's CHEMICAL NEWS, and as by some accident that discussion was *not* reported, I take this opportunity of putting forward my views on the subject.

It is, perhaps, unnecessary that I should warn chemists against following Dr. Brown's advice to take 40 or 50 c.c.

of milk for evaporation instead of the 5 c.c. recommended in my little book on "Milk Analysis." The convenience and advantage of the smaller over the larger quantity is appreciated by many persons, but, for the benefit of such persons as may have adopted the larger quantity, I will just remark that by taking 5 c.c. of milk, results correct to within a small figure in the second decimal place in percentage may be obtained in from three to four hours, whilst a like accuracy is not attainable in the space of eight hours if the large quantity be taken. I am indeed in some doubt as to whether it is possible to make a perfect desiccation of the larger quantity without some degree of decomposition setting in.

Dr. Brown's advice to maintain the milk residue at 99° C. for one hour in the air-bath before being weighed, appears to me to be quite superfluous. I never do anything of the kind, and my milk dishes containing the dry residues are taken out of the water-bath, wiped, and at once weighed.

According to Dr. Brown's experiments the "solids not fat," which usually amount to 9.3 per cent of the milk, fell in three instances out of about 400 samples of milk to a little below 9.0 per cent, *viz.*, to 8.94, 8.95, and 8.81. The limit which is accepted by the Society of Public Analysts is 9.0 per cent.

I cannot help remarking that the result of this investigation, as far as it goes, is favourable to the official standard, the numbers 8.94 and 8.95 being sufficiently near the standard, whilst there thus remains only one contrary number, *viz.*, 8.81, out of the analyses of some 300 to 400 samples of milk; and possibly if Dr. Brown had operated upon 5 c.c. of milk instead of upon 40 or 50 c.c., he would not even have met with this one contrary instance. Be this, however, as it may, this isolated instance is quite unimportant to the Public Analyst.—I am, &c.

J. ALFRED WANKLYN.

117, Charlotte Street, Fitzroy Square,
June 22, 1875.

NOTICES OF BOOKS.

Year-Book of Pharmacy, Comprising Abstracts of Papers Contributed to British and Foreign Journals from July 1, 1873, to June, 1874. With the *Transactions of the British Pharmaceutical Conference* at the Eleventh Annual Meeting held at London, August, 1874. London: J. and A. Churchill.

It is not every book of which the title explains so fully its aim and object, and very few, indeed, are there that profess much in their titles which will bear investigation so well as the volume under notice. As the official record of a peripatetic society modelled after, and usually following, the British Association, it is given away to the thousand and one members who pay the very moderate subscription required, and it is not too much to say that the book alone is well worth the money, even if there were no other advantages to be enjoyed by the members. The "Year-Book of Pharmacy" has hitherto been edited by Professor Attfield, but the present volume has been compiled by Mr. Louis Siebold, of Manchester, and very well this gentleman has performed his difficult task.

In addition to the abstracts of papers which have appeared in the CHEMICAL NEWS, or which deal with matters relating to pure pharmacy, there are many others connected with pharmaceutical chemistry in its widest sense, and which will well repay a careful perusal. The Public Analyst especially will get many a hint for the detection of ill-defined organic bodies, and for the invention of new methods of analysis.

A valuable feature of the book, which might be advantageously adopted in other cases, is the "introduction," which is in effect a very useful summary of the chief

discoveries of the year and of the leading facts and processes afterwards detailed.

The arrangement and type of the book are unexceptionable, and the *errata* not more numerous than must be expected in a work of the character.

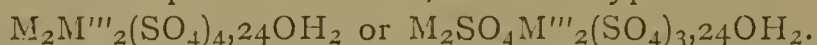
CORRESPONDENCE.

SILVER-AMMONIUM ALUM (?).

To the Editor of the Chemical News.

SIR,—With reference to the query of Mr. S. E. Phillips as to this substance, in your last issue, I noted the incorrectness in M. Sergius Kern's note (CHEMICAL NEWS, vol. xxxi., p. 209), and have waited to see whether anyone would correct him. Professor Church has shown that what he stated as new about Ag-Al alum was already known.

The query of Mr. Phillips touches the erroneous view of M. Kern as to what constitutes an alum. I presume it is generally well known that, letting M represent an atom of a monad basylous element or radicle, and M''' an atom of a triad or pseudo-triad one, the alum-type is—



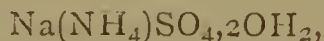
I cannot admit the truth of Mr. Phillips's remark, that "the difference of character," or constitution of these salts, "may, perhaps, be better seen by using the old notation." It may be by him, since he generally adopts it, but not necessarily so by others. It is evidently a matter of training and use.

The so-called silver-ammonium alum does not conform to the alum type given above, even if we assume M. Kern's formula, $Ag_2(NH_4)_2(SO_4)_2, 24OH_2$, to be correct, ammonium being a monad radical, and not a triad one; consequently the salt is a double sulphate of silver and ammonium, and not an alum at all. M. Kern speaks of the crystals being "isomorphic;" he leaves it to be inferred that he means *with the alums*, which, I believe, on examination, it will be found not to be.

Further, I submit that M. Kern has very likely assumed, without making any determination, that the salt contains 24 molecules of water of crystallisation, like the alums, and that, if he will examine the salt with regard to this point, he will probably find that it contains *two* molecules of water of crystallisation rather than twenty-four, its formula being—



corresponding to—



a double sulphate the constitution of which is known.—I am, &c.,

W. H. WOOD.

Halifax, June 22, 1875.

ON THE MINIMUM SOLIDS IN MILK.

To the Editor of the Chemical News.

SIR,—In CHEMICAL NEWS, vol. xxxi., p. 267, there appeared a "Table showing the Adulteration by Water of Milk which originally contained the Minimum of 11 per cent of Solids, including Fat." It begins with 11 per cent and is carried down to 1 per cent of solids, which latter quantity is equal to 10 parts of water added to 1 part of the poorest milk; an adulteration which it would scarcely require an analyst to detect, and which, in fact, might be considered as water adulterated with milk. I think it would have been sufficient to have given the minimum amount of solids which Dr. Campbell Brown considers as the standard to be taken in prosecutions for adulteration, and to have let chemists calculate for themselves (and surely they are capable of doing so) the amount of adulteration in any given sample.

Half the table might certainly have been omitted, as no milkman is likely to add to his milk more than an equal amount of water; and the other half can only be of use when the percentage of solids in the sample under examination coincides with the figures in the first column.—I am, &c.,

A. S.

Stoke Newington, June 19, 1875.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Seances de l'Academie des Sciences, No. 19, May 17, 1875.

Chemical and Physiological Ferments.—M. A. Müntz.—The author points out the distinctions between these two classes of ferments. The ferments endowed with life have their maximum action at temperatures from 25° to 40°. The generality of chemical ferments have their maximum action at higher points. Chloroform entirely arrests all fermentation depending on vital action, but is without influence on purely chemical fermentation.

Experiments and Observations on the Viscous Fermentation.—M. A. Baudrimont.—The viscous fermentation, at least at its commencement, is not due to an alteration of the sugar, but simply a special development of the ferment which it contains.

No. 21, May 31, 1875.

Researches on the Sulphines.—M. A. Cahours.—The author examines the action of the bromide of benzyl on the sulphide of methyl; of the iodide of methyl upon the sulphide of methyl; of the di-iodide of methylen upon the sulphide of methyl; and of the bromide of ethylen upon the same compound.

Alteration of the Seine from November, 1874, to May, 1875.—M. A. Gérardin.—The author judges of the amelioration of the water by determining the amount of dissolved oxygen.

New Method of Preparing Highly Concentrated Formic Acid by means of Dehydrated Oxalic Acid and a Polyatomic Alcohol.—M. Lorin.—Into a rather large tubulated retort is introduced white glycerin, which is concentrated by heat before the addition of the dehydrated oxalic acid in powder. The retort is heated in the water-bath. Decomposition takes place about 80°, but it is much accelerated by a slight rise of temperature, and at 87° the liquid is covered with a layer of bubbles half a centimetre in thickness. When the decomposition slackens more oxalic acid is added. The formic acid is absolutely free from allyl compounds, and contains 94 per cent of actual acid.

Isomerism of the Hydrochlorates, $C_{10}H_{16}HCl$.—M. J. Ribau.—Hydrochlorate of terebenthen is absolutely undecomposable by cold water; it only gives off very slight quantities of hydrochloric acid at 100°, and rapidly loses the totality of its acid at 200°, becoming converted into tereben. Stearate of soda and alcoholic potash transform it into active camphene, and acetate of soda into the inactive form. Hydrochlorate of tereben is rapidly decomposed by cold water with production of β -camphene; by water at 100°, with regeneration of tereben as a liquid body. Stearate of soda changes it into a mixture of regenerated tereben and of β -camphene. The mono-hydrochlorate of the various camphenes is slowly decomposable by cold water; with water at 100°, with alcoholic potash and stearate of soda it regenerates camphene as a solid body. The hydrochloric ether of the borneols having the same formula, behaves like the latter series

of bodies, and belongs, consequently, to the hydrochlorate of camphene type.

Origin of the Phylloxera at Cognac.—M. Mouillefert.

Use of the Xanthate of Potash against the Phylloxera.—MM. Zœller and A. Grete.—This salt liberates sulphide of carbon, fatal to the phylloxera, especially in contact with superphosphate.

Presence of the Phylloxera in Auvergne.—M. Julien.

Influence of Moisture on the Phylloxera.—M. Ville-dieu.—In dry weather the phylloxera descends; in rainy weather it approaches the surface.

Researches on the Rapidity of Magnetisation and Demagnetisation of Iron, Cast-Iron, and Steel.—M. Deprez.—Soft iron, common iron, malleable cast-iron, and even tempered steel give approximately the same results for the duration of the phases of magnetisation and demagnetisation.

Rotatory Power of Crystalline Sugar, and on the Sampling of Sugars Submitted to Polarimetric Analysis.—MM. V. de Luynes and A. Girard.—Optical saccharimetry is based essentially on the following data:—The graduation of the apparatus and the taking of the sample. The graduation of the apparatus is such that 100 saccharimetric degrees correspond exactly to the rotation produced by a plate of quartz perpendicular to the axis, and measuring 1 m.m. in thickness. The sample is represented by the weight of pure sugar which would, under the same conditions, produce the same rotation as this plate of quartz. Sometimes, when proceeding on these data, we observe singular anomalies. Samples are met with which mark by the saccharimeter 100.5°, and even 101°. The authors agree with M. Dubrunfaut that 16.35 grms. is too large a quantity to take for optical examination, and that the proper weight is 16.19 grms.

Remarks Concerning a Paper by M. Gayon on the Spontaneous Decomposition of Eggs.*—M. A. Béchamp.—The author denies that putrid eggs invariably contain bacteria or vibriones.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale, No. 17, May, 1875.

Report Given by Count du Moncel on the Telegraphic Indicator for the Use of Hotels.—M. Debayeux.—This paper requires the accompanying illustration.

Report Given by M. Cloëz on the Superphosphate Works of MM. Michelet and Thibault.—The peculiarity of this establishment is that the phosphates are mixed with the acid in closed vessels from which the noxious vapours are drawn by an aspirator, traverse a tower filled with wet coke, and pass finally into the chimney of the works. The phosphatic minerals are ground and sifted for use, and the acid is employed at 53° B. The phosphorites used are those of the Lot, the Ardennes, and of Estremadura. The vapours given off by the first-mentioned kind yield a certain amount of iodine. The arrangement of the plant cannot be made intelligible without engravings.

Report Presented by Count du Moncel on the Thermo-Electric Battery of M. Clamond.—In this battery the electro-positive element is of iron, and the negative element an alloy of antimony and zinc. In M. Clamond's arrangement, as in that of Mr. Farmer, the elements are connected circularly for intensity, forming a kind of crowns, isolated from each other by plates of amianthus, and having their polar extremities placed in connection with a commutator, fixed tangentially to the cylindrical surface of the apparatus, and contrived so as cause these crowns to be grouped either for intensity or for quantity, as may be requisite. The apparatus has been employed for six months at the galvano-plastic works of M. Goupil at Asnières. The gas consumed

amounts to 2½ frs. per kilo. of copper deposited. This paper is accompanied with several illustrations.

New Balance of M. Mendeleef.—Requires the accompanying diagram.

Observations on the Use of the Tincture of Guaiacum as a Test for the Purity of Kirschwasser.—M. Boussingault.—The blue colouration relied on as a characteristic of genuine kirsch is due to traces of copper. In presence of hydrocyanic acid tincture of guaiacum is the best reagent for this metal.

Central-Blatt für Agrikultur Chemie,
Heft 3, March, 1875.

Periodicity of Hail.—Prof. H. Fritz.—The author finds that the seasons when hail is most frequent are those in which spots in the sun are most numerous. On the other hand, the years when solar spots are at their minimum are characterised by the rarity or absence of hail. It has also been observed that when the aurora is very frequent during the winter, frequent hail-storms occur in the following summer.

Studies on Arable Soils.—Th. Schlösing.—The author has examined the influence of the salts present in a soil upon its openness of texture. Mould stirred up in water subsides the more rapidly the more salts are present, especially those of lime and magnesia. This phenomenon, which amounts to a coagulation of the clay, is thoroughly examined. The best precipitants for clay are caustic lime and the lime salts.

Contribution to the Knowledge of Arable Soils.—Prof. W. Knop.—The author gives the analysis of the sediment of the former lake, Fucino, near Avezano, in the Abruzzi (now drained). This soil, like the mud of the Nile, though very fruitful, contains little humus.

Utilisation of the Waste Hydrochloric Liquid from the Manufacture of Bone-Glue.—Dr. P. Wehle.—The dilute muriatic acid used in extracting the bone-earth from the gelatin is neutralised with milk of lime, when phosphate of lime is deposited in a state of fine division.

Residues of the Olive Oil Manufacture, and their Utilisation as Manure.—Prof. F. Sestini and G. del Torre.—The dregs of the oil, and the black water which flows out of the press along with the oil, are useful as manure, after their acidity has been previously neutralised with lime. The olive-cake is of little value.

Solution of Phosphorite by Admixture in Composts.—Dr. F. Holdefleiss.—The author has attempted to render the Nassau phosphorite—unfavourably known from its tendency to "reversion"—soluble by mixture with various organic matters. Peat, especially in company with ammoniacal salts, gave the best results.

A New Contribution to the Sewage Irrigation Question.—An account of the Leamington irrigation farm, taken from *Der Landwirth*. The milk of cows fed on the sewage grass is said to have been analysed by Dr. Swete, who found it "very rich, and not in the slightest degree infected." The editor judiciously remarks that the "rentability" of sewage farms can only be decided by accurate balance sheets.

Quantity and Quality of the Milk of Cows of Different Breeds and Strains.—Messrs. Kildal, Elstrand, Dirks, Moser, and Belleville.—These researches prove that the composition of genuine milk fluctuates very little. In all the quantities examined, the lowest amount of water was 86.58 per cent, and the highest 88.18.

Experiments on the Chemistry of the Process of Saccharification by means of Malt.—Dr. P. Wagner.—In grain distilleries farina is converted into a mixture of glucose and dextrin by the addition of malt. The production of lactic and acids should be carefully avoided since they both have a destructive action upon diastase.

Detection of Adulterated Wines.—Prof. J. Nessler. The author points out that genuine wines contain, chiefly

* *Comptes Rendus*, lxxx., p. 1096.

malic acid. Free tartaric acid is very rarely found, except in spurious concoctions. As a test the author uses a solution of 5 grms. acetate of potash, 5 grms. alcohol, and 25 grms. water. If an appreciable amount of tartaric acid is present, this test produces a crystalline deposit of tartar in a quarter of an hour; whilst, in genuine wines, even if they contain a trace of tartaric acid, no precipitate appears until some hours have elapsed. Genuine wine contains no citric acid. For its detection in small quantities, the wine is rendered alkaline and filtered, acidulated with acetic acid, mixed with chloride of barium, filtered, and a few drops of ammonia added to the filtrate until it has an alkaline reaction. If, on the addition of baryta-water, a white precipitate appears, citric acid is present. Oxalic acid gives a white precipitate if lime-water is added in such small quantities that the liquid has still an alkaline reaction. Sulphuric acid in genuine wines is found only to the extent of 0.03 to 0.05 per cent.

Influence of Phosphates and of Certain Gases upon Putrefaction.—L. Lefort and V. Paschutin.—The authors confirm the results of Collas on the putrefactive agency of gelatinous phosphate of lime. They find no volatile compounds of phosphorus—such as phosphide of hydrogen—among the products of putrefying organic bodies. Muscular flesh, preserved for ten months in various gases free from oxygen, did not putrefy, but when afterwards exposed to the air they underwent decomposition almost as rapidly as recent flesh.

Les Mondes, Revue Hebdomadaire des Sciences.

No. 1, May 6, 1875.

This number contains no original chemical matter.

No. 2, May 13, 1875.

Electro-Dynamic Machine.—M. H. Fontaine.—A reply by the author to a paper in which the invention of Gramme's electro-magnetic machines is claimed for M. Lonten.

Determination of Tannin.—A. Carpeni.—The reagent proposed is ammoniacal acetate of zinc, with a great excess of ammonia. It forms a tannate of zinc, quite insoluble in water, ammonia, and an excess of the reagent. The precipitate is heated almost to a boil, and, after cooling, it is collected on a filter, and washed with boiling water. It is then re-dissolved in dilute sulphuric acid, and determined by means of permanganate of potash, —1°=0.0076 gm. of tannic acid.

Reimann's Farber Zeitung, No. 16, 1875.

This issue contains a notice of the origin and development of the manufacture of bismark brown (phenylen-diamin brown). There follows the conclusion of the paper on dyeing half-woollen doubles; receipts for a red, a yellow, and a prussian green on jute; for printing a chrome grey on calico; for a fast ponceau on woollen piece goods and on wool; receipts for burling inks; an indelible and bleach-proof ink for marbling cotton and linen pieces; and an improved method of printing fast blues. This process, proposed by Jeannaire, is as follows:—He mixes ground indigo with soda-lye, and the tartrate either of protoxide of tin (stannous tartrate), or of protoxide of iron (ferrous tartrate), thickens with dextrin, and prints. The colour is kept thin, and is heated to 30° to 40° for use, and mixed with 1 to 2 per cent of petroleum to prevent frothing. Before printing, the goods are passed through glycerin (1 to 2 parts of glycerin to 16 of water), or a mixture of glycerin and arsenic, or glycerin and tin-crystals, 25 grms. per litre, may be used. After printing, the pieces are hung, the next day, in a current of water, or passed the same day through sulphuric acid at sp. gr. 1.01, washed, and soaped. The tartrate of protoxide of iron is prepared by dissolving 500 grms. protochloride of iron, 1 kilo. of tartaric acid, and 50 grms. of tin-crystals, in the smallest possible quantity of hot water.

MISCELLANEOUS.

Filtered Thames Water, and Spring Water from Chalk Strata.—S. C. Homersham, in the *Journal of the Society of Arts*, May 28, 1875, holds that spring water from the chalk strata has a uniform annual temperature varying little from 50° F. That it is clear, transparent, bright, and, in large bulk, of a pure blue colour. That it holds in solution per gallon two or more cubic inches of oxygen and six of nitrogen. That it is free from living organisms, vegetable or animal, and from all dead organic matter, whether in suspension or solution. On the other hand, he urges that filtered river water has in summer a temperature of 68° to 72° F., and in winter of 34° to 36° F. That it is more or less opaque, and devoid of transparency and brightness; that it holds in solution a smaller quantity of oxygen than does spring water, and that it contains in suspension manure, faecal matters, living organisms, animal and vegetable, and the virus of specific diseases. He calculates that as the average thickness of the chalk is 800 ft., it would take a depth of 260 ft. of rain, or the produce of two centuries, to saturate the pores, and infers hence that so slow and delicate a process of filtration may naturally be expected to produce results superior to the coarse and rapid filtration of water companies.

NOTES AND QUERIES.

** Our Notes and Queries column was opened for the purpose of giving and obtaining information likely to be of use to our readers generally. We cannot undertake to let this column be the means of transmitting merely private information, or such trade notices as should legitimately come in the advertising columns.

Soap for Scouring Woollens.—Will some reader of the *CHEMICAL NEWS* kindly inform me how to make a good soap suitable for scouring woollen yarn?—S. G.

Osmosis, Dialysis, and Diffusion.—Could any of your readers inform me of the best book written on osmosis, dialysis, and diffusion, &c., as I wish to study the subject?—A READER.

Action of Vinegar on Tin.—Can any correspondent inform me whether the vinegar of commerce attacks the tins used in preserving meats, and whether the same extracts any poisonous ingredients from such tins?—B. S.

MEETINGS FOR THE WEEK.

SATURDAY, June 26th.—Physical. "On the Electrical Conductivity of Liquids," by W. J. Wilson. "On Subjective Sensations of Taste," by Dr. W. H. Stone.

WEDNESDAY, June 30th.—Society of Arts, 4. (Anniversary.)

FRIDAY, July 2nd.—Geologists' Association, 8.

British Association for the Advancement of SCIENCE.

22, Albemarle Street, London, W.

The NEXT ANNUAL GENERAL MEETING will be held at BRISTOL, commencing on Wednesday, August 25.

President:

SIR JOHN HAWKSHAW, C.E., F.R.S., &c.

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